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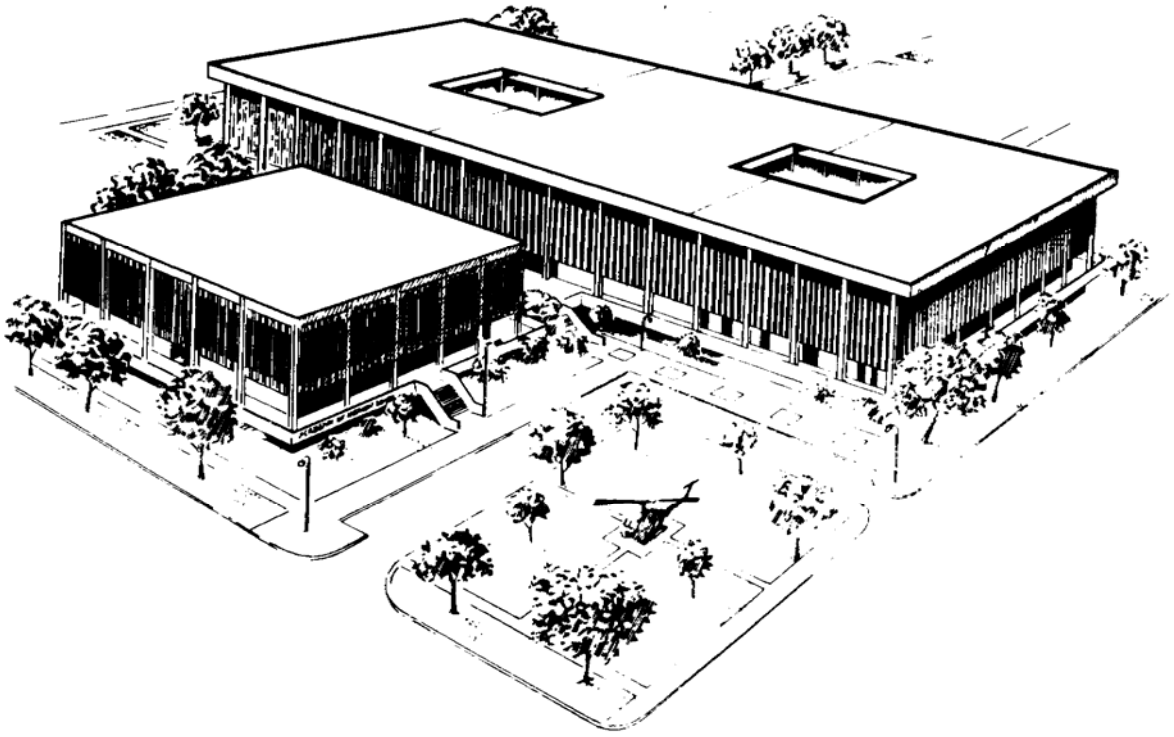
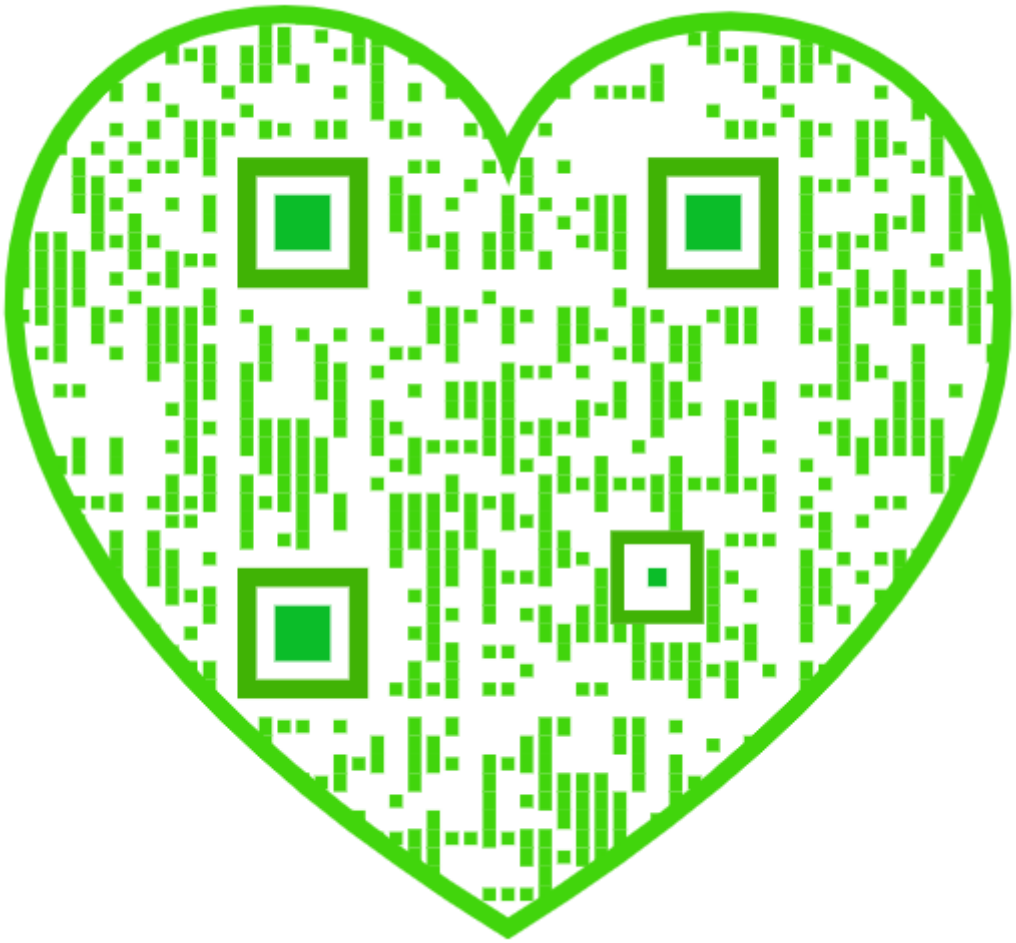


ENVIRONMENTAL DISEASES/INJURIES I

SUBCOURSE MD0588 EDITION 200



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When used in this publication, words such as "he," "him," "his," and "men" are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.

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CORRESPONDENCE COURSE OF
THE U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0588

ENVIRONMENTAL DISEASES/INJURIES I

INTRODUCTION

This subcourse on environmental disease and injuries includes sections on venomous snake bites, spider bites, insect stings and bites, anaphylactic shock, poisonous marine animals, and hepatitis. The identification of types of snake bites and types of venoms is the main concern of the section on snakes. The snakes described here will be found mainly in the United States. For those soldiers assigned to other parts of the world, supplementary information will be provided by proper persons when an assignment is made. It is not possible to include all species of snakes and their varieties in this subcourse. A LAC-USC Guide for Snake Venom Poisoning is included at the end of the first lesson.

The spiders that are identified can be as lethal as some types of snakes, but many of the insects are not. These insects are included because they are medically important in terms of pain and the possibility of an allergic reaction. Many people can show an allergy that will progress to anaphylactic shock. Some types of marine life can emit a poison that is more lethal than that of any snake, and many military personnel are stationed at or near the habitats of these animals. The lesson on hepatitis identifies the various types of this disease. The routes of person to person transmission, and disease precautions, will be of special interest.

Some of the terms used in this course, both medical and English, may be unfamiliar to you. You, as a Medical NCO, will have frequent contact with the physician and physician assistants. You need to understand and interpret their vocabulary. It would be a wise idea to use one of the excellent medical dictionaries available in most bookstores and libraries. Examples are Dorland's Illustrated Medical Dictionary (published by W. B. Saunders Company) or Taber's Cyclopedia Medical Dictionary (published by F. A. Davis Company). For general English usage, an example is Webster's New Collegiate Dictionary (published by G. and C. Merriam Company). Do not feel constrained by these examples. Any good dictionary will be useful.

For your convenience, we have included a glossary of special terms at the end of this subcourse. Take a few minutes to read this glossary before you start the lessons. It will save you some dictionary time later. We suggest that you do not attempt to master large amounts of this information at one sitting. This would be especially difficult if some of the material is new to you.

Subcourse Components:

The subcourse instructional material consists of four lessons and two appendixes as follows:

Lesson 1, Snake Bites.
Lesson 2, Bites and Stings.
Lesson 3, Anaphylaxis and Anaphylactic Shock.
Lesson 4, Hepatitis.
Appendix A, Snake Venom Poisoning and Antivenins
Appendix B, Glossary

--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson

--After completing each set of lesson exercises, compare your answers with those on the solution sheet that follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

Credit Awarded:

Upon successful completion of the examination for this subcourse, you will be awarded 6 credit hours.

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Section at Fort Sam Houston, Texas.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

LESSON ASSIGNMENT

LESSON 1	Snakebites.
TEXT ASSIGNMENT	Paragraph 1-1 through 1-10 and Appendixes.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

1-1. Identify types of venomous reptiles according to the signs and symptoms of venom type.

1-2. Identify the treatment given for the different signs/symptoms of venomous reptile bites.

1-3. Identify common practices used to prevent reptile bites.

SUGGESTION	After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

SNAKEBITES

1-1. GENERAL

An emergency that can occur that is not directly related to a combat area is the bite of a snake. As a Medical NCO responsible for caring for a variety of patients, the information contained in this lesson concerning snakebites is invaluable because a snakebite can occur almost anyplace. A snake will usually avoid people unless it is injured, trapped, or somehow disturbed. In these cases, it will defend itself. An aggressive type of snake may attack without apparent provocation. Snakes tend to display more aggressiveness during their breeding season. Although there are over 2,500 known species of snakes in the world, less than 200 are potentially dangerous. All species of snakes can swim, and many of the snakes can remain under water for long periods without drowning. A bite sustained in water is just as dangerous as one on dry land. Often the thought of snakebite creates fear and confusion, combined with anxiety about what to do. This reaction can be overcome when first aid for snakebites is understood.

1-2. CLASSIFICATION OF VENOMOUS REPTILES

a. **Family Helodermatidae.** The two lizards of the Helodermatidae family are the Gila monster (Heloderma suspectum) and the beaded lizard (H. horridum) (figure 1-1). These lizards are unique because they have grooved teeth and venom glands. They can be found in the southwestern part of the United States and in Mexico. The Gila monster is a large, corpulent, relatively slow-moving, and largely nocturnal reptile that may reach an overall length of 550 mm. Its life span is normally 10 to 25 years, and some records have noted even as many as 27 years. The location of the Gila monster's venom glands is on either side of the lower jaw. The glands consist of several lobes, and there is a separate duct for each gland to carry the venom to the mucous membrane between the lower jaw and the lip and the lip near the base of the tooth. Through capillary action, the venom travels from the duct to the grooves of the lower teeth (figure 1-2), then the venom is drawn into the puncture wound made by the tooth. It is relatively rare that a Gila monster bites unless there has been careless handling of it during captivity, it may not always expel venom. The venom has local irritant hemotoxic and neurotoxic effects.

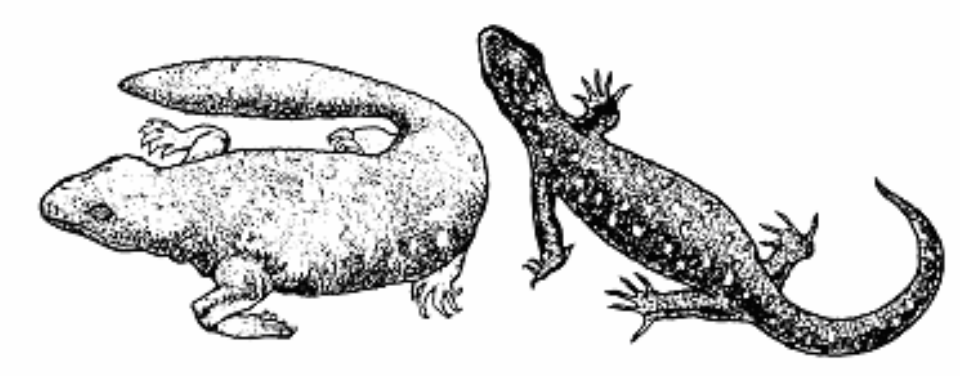


Figure 1-1. Gila monster and a beaded lizard.

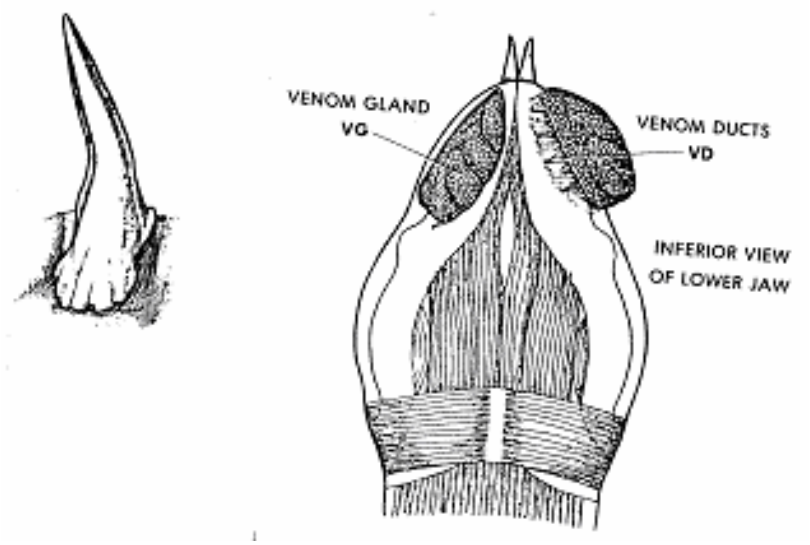


Figure 1-2. A beaded lizard's tooth and the venom apparatus of the Gila monster.

b. **Family Colubridae.** Of the over 1000 species of snakes in the Colubridae family, there are some 200 venomous species. The boomslang (Dispholidus typhus) of South Africa and the bird snake (Thelotornis kirtlandii) are found in this group. They are found in mostly tropical and subtropical areas and have grooved fangs on the posterian maxillae (rear fangs). Although little is known concerning the venoms, some are powerfully hemorrhagic. This venom has been implicated in fatal envenomations.

c. **Family Elapidae.** The snakes of this family (figure 1-3) are referred to as the elapids and include over 150 species of coral and venomous snakes of Australia. The coral snakes have bright rings of red, white or yellow, and black across their bodies to make them the most beautifully colored of the venomous snakes. Corals are relatively small snakes and their secretive and burrowing habits keep contact with humans rather rare and bites even rarer. The eastern coral snake (Micrurus fulvius), the Texas coral snake (M. Tenere), and the Arizona or Sonoran coral snake (Micruroides euryxanthus) are found in the United States. They are fixed fangs on the anterior ends of the maxillae and the venom is predominately neurotoxic and potent.

Figure 1-3. Snakes of the family Elapidae.

d. **Family Hydrophidae.** There are approximately 100 species in this family. The words "adder" and "viper" are commonly used in literature and in a few areas of the world. "Adder" may be used to describe nonvenomous snakes (for example, hognose and milk snake in North America). These snakes can be found in Southeast Asia and the southwest Pacific Islands. One species reaches the western coasts of tropical America. They have short fangs and the venoms act primarily on skeletal muscle. The venom of these snakes is often extremely potent but small in quantity.

e. **Family Crotalidae.** There are approximately 100 species of Crotalidae. Many are pit vipers. The best-known pit vipers are the rattlesnakes. Rattlesnakes are found in North, South, and Central America and all of them are venomous. With the exception of Crotalus catalinensis, all rattlesnakes have rattles. They are relatively heavy bodied, have broad heads, and are marked with blotches or cross bands over the back. In addition to the rattlesnake, some common names of snakes in the family are moccasins, new world pit vipers, bushmasters, massasaugas and pygmy rattlesnakes. There is also the Asiatic pit viper found in Asia. These snakes have single large fangs on short and their otherwise toothless maxillae rotate which permits the fangs to be erected or folded against the roof of the mouth (hinged). The venom usually causes local necrosis and hemorrhage.

f. **Family Viperinae.** There are approximately 50 species in this family. These snakes can be found in Africa, Asia, and Europe. They have large hinged fangs and the venom is extremely necrotic and hemorrhagic. One of the deadliest members of this family is the Gaboon viper.

1-3. GENERAL CHARACTERISTICS OF U.S. CROTALINAE

Rattlesnakes, moccasins, and copperheads are classified as pit vipers. They have large fangs and deeply inject a large amount of venom. The name "pit viper" is derived from the deep pit between the eye and nostril on each side of the head. Inside this pit is a sensory organ that is capable of detecting small amounts of radiant heat. The pit viper's head is flat and triangular-shaped and is very distinct from its neck; its eyes have a cat-like pupil and are elliptical; and it has a thick, stout body with a thin neck.

1-4. INDIVIDUAL CHARACTERISTICS OF U.S. CROTALINAE

a. **Rattlesnake (Crotalus).** There are some 51 species of the rattlesnake (figure 1-4) that can be found in every state of the continental U.S. with the exception of Maine. This snake lives in dry desert areas, grassy plains, forests, and in rocky areas. One can easily identify this snake due to the audible rattles at the end of the tail; however, one species found in an island off southern California is called the "rattleless" rattlesnake because it has no rattle. Rattlesnakes grow to a length of two to eight feet. The color and markings vary according to the species and the region where it is found. However, three or more species may be found in the same locale in parts of Texas, New Mexico, Arizona, and California. In these areas, identification may be difficult.

Figure 1-4. Pit vipers.

b. **Water Moccasin (Cottonmouth) (Agkistrodon, 2 Species).** The water moccasin (figure 1-5) is found in the southern Mississippi Valley states eastward to Florida since it prefers low swampy land and lake areas. It can be identified by its elliptical pupils, facial pits, and absence of rattles, and usually a single row of scales on the underside of the tail. When the cottonmouth becomes excited, it coils its head back with its mouth open, revealing the white inside of its mouth (hence, the name "cottonmouth"). This snake can grow to a length between 3 to 5 feet and it is dark brown and black.

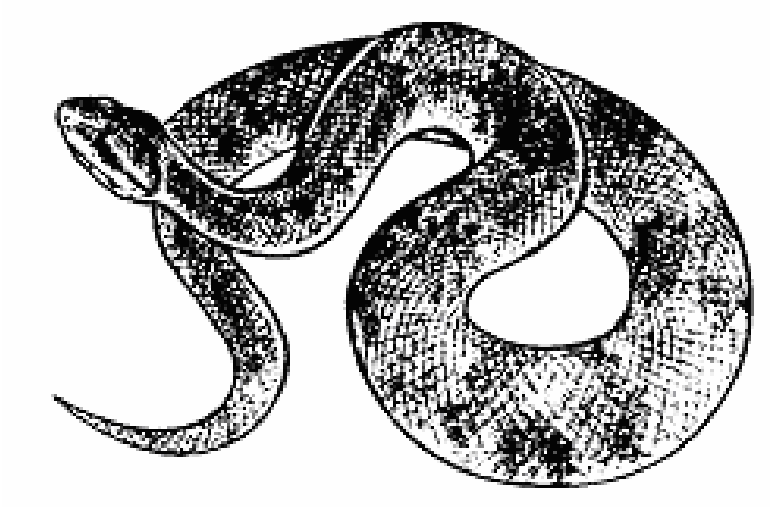


Figure 1-5. Agkistrodon piscivorus (Cottonmouth).

c. **Copperhead (Agkistrodon, 5 Species).** The copperhead (figure 1-6) can be found in the eastern half of the U.S. from Texas to the east coast. The Northern Copperhead usually nests in the rocky and wooded areas away from water. The Southern Copperhead tends to nest near water and low lying areas. When grown, this snake is from 2 to 4 feet long. Its color patterns vary greatly, the head being the color of copper or reddish brown with an hourglass shape on its back.

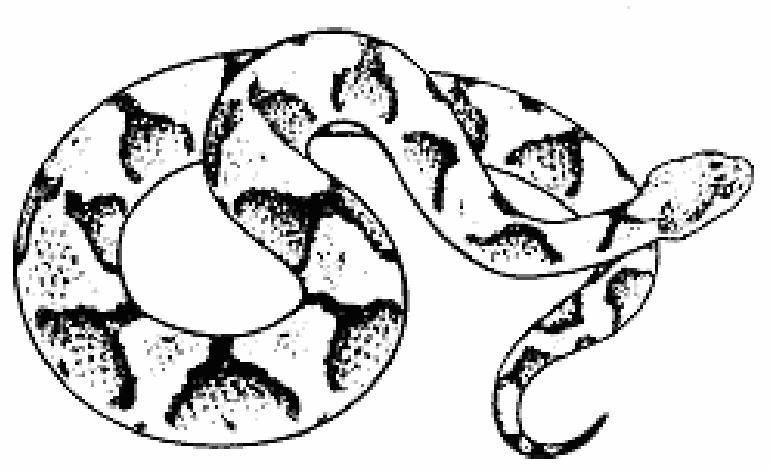


Figure 1-6. Agkistrodon contortrix (Copperhead).

1-5. INDIVIDUAL CHARACTERISTICS OF U.S. ELAPIDAE

a. **Coral Snakes (Micrurus, 2 Species).** This snake is found mainly in the southern states and northward along the Mississippi Valley to Indiana. It prefers to remain under loosely packed materials such as bark of decaying logs. It is the most beautifully colored of the venomous snakes with the bands of black, yellow, and red encircling its body (yellow rings are located on either side of the black). It is a small snake, 1 1/2 to 3 feet long when grown, is shy and docile, and has almost round pupils. It does not have the facial pits of other venomous snakes of the U.S.

b. **Coral Snake (Micruroides, 2 Species).** The coral snake is located in Arizona and the southwest top of New Mexico. It lives in rocky areas, the plains to the lower mountain slopes, and the rocky upland desert, especially in arroyos and river bottoms. It grows to become 1 to 2 feet when it is mature. Its body is encircled by bands of black, cream and red (cream rings are located on either side of the black). One method to identify the U.S. coral snake from harmless snakes is to remember this: "Red on yellow, kill a fellow; red on black, venom lack." This saying is only true in the United States as the Panamanian Coral Snake has only two colors red and yellow or yellow and black. Its poison is the most toxic of any of the poisonous snakes in the U.S. It has several pairs of short, rigid grooved fangs at the end of the upper. For this reason, the coral snake uses a chewing motion to inject its poison. This snake usually bites the victim on a hand, foot, or finger since it has a small mouth, teeth, and limited jaw expansion. The poison injected is neurotoxic and affects the victim's cranial nerves (paralysis of respiratory movements, eyelids and eyeball movements).

1-6. INDIVIDUAL CHARACTERISTICS OF U.S. HELODERMATIDAE

a. **Gila Monster and Mexican Beaded Lizard (Heloderma).** These lizards can be found in areas from southern Arizona to the southwestern part of New Mexico and in Northern Mexico where they live in the rocky areas, desert arroyos, and river bottoms. They are the only venomous lizards and grow to a length of 1 to 2 feet. They have black and orange or yellow rough beadlike skin with a large stout body and fat tail which of necessity makes moving relatively slow and mostly in the night. Their eyes are beadlike and small and their mouths are large and muscular.

b. **Heloderma Venom Signs and Symptoms.** The lizard's bite is a simple puncture wound leaving from 1 to 8 teeth marks. It causes severe, excruciating pain and slow progressive swelling. The person suffers weakness and vertigo, cyanosis and local tenderness about the wound, nausea, and vomiting. The bite can cause tachycardia, hypotension, and respiratory distress.

1-7. VENOM CHARACTERISTICS

a. **Types of Venom.** Snake venoms contain a very complicated mixture of different substances that are toxic to many cells and tissues of the body. Most venoms are either primarily neurotoxic (poisonous to the nervous system) such as the venom of the coral snake; hemotoxic (poisonous to the circulatory system) such as the venom of the rattlesnake, or a combination of the two.

b. **Snake Venom Functions.** The snake subdues its prey primarily by toxic peptides. The snake digests its prey using approximately 26 different toxic enzymes, although no single venom contains all of these. These enzymes develop the majority of the signs and symptoms of snakebites.

c. **Hemotoxic Venom Signs and Symptoms.** There is no venom injected in some 20 percent of snakebites involving poisonous snakes. When it is injected, there is usually a rapid, voluminous swelling at the site of the bite and it is so severe that it may spontaneously burst the skin. The victim usually has a rapid onset of excruciating and burning pain and exhibits stimulation followed by depression rapidly. The anticoagulant component of venom causes blood to appear in the urine or stool, bleeding from the lips, gums, and nails, and oozing at the site of the bite. The puncture may become discolored (erythema, ecchymosis), followed by necrosis. The snakebite victim may go into shock.

d. **Neurotoxic Venom Signs and Symptoms.** Neurotoxic venom affects the central nervous system (for example, venom from a coral snake). In this case, there is little or no pain at the site of the bite and very little or no swelling. The victim suffers vertigo, blurred vision or blindness, and paresthesia (numbness) in the area of the bite and around the mouth and throat. He has difficulty in hearing, increased salivation, slurred speech, and respiratory arrest. Of course, respiratory distress may be exhibited in all poisonous snakebites, but the primary danger is with neurotoxic venom. The victim may also suffer GI disorders (violent abdominal pain) and convulsions.

1-8. OBJECTIVES OF SNAKEBITE FIRST AID

First aid is administered to reduce the circulation of blood through the bitten area, to delay absorption of the venom, to prevent aggravation of the local wound, and to sustain respiration.

1-9. TREATMENT OF REPTILE BITES

a. The severity of the symptoms depends on the amount of venom injected by the reptile and whether it was injected into a blood vessel or into the muscle or fatty tissue. Within practical limits, achieve immediate, absolute immobilization of the affected part in a position that is at the level of the heart or slightly lower. Place the patient in prone position, reassure him, and keep him as calm as possible. Tell him not to move, explain to the patient what you are doing, and tell him that evacuation will be accomplished as soon as possible. If the patient has been bitten on an extremity, keep the bitten part at or below the heart level to slow down the spread of the poison to the heart.

b. Do **NOT** kill the reptile unless there is need to protect someone. There is no need to kill the reptile if you can properly identify it. Snakes are very dangerous and should only be handled by trained personnel. Handling even the head of the deceased snake can cause an accidental envenomation. Doctors can identify signs and symptoms of venomous snake bites without a positive identification. Common bite patterns of nonpoisonous (figure 1-7) and poisonous (figure 1-8) snakes are shown below.

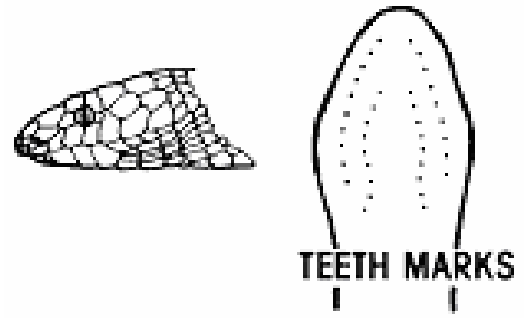


Figure 1-7. Teeth marks of nonpoisonous snakes.

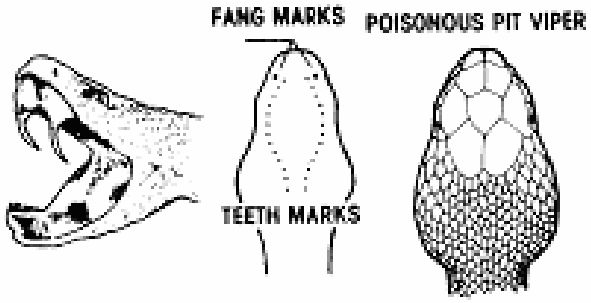


Figure 1-8. Fang marks of poisonous pit viper snakes.

c. **DO NOT** give the patient any alcoholic beverages, stimulants (such as coffee), or sedation. While certain analgesics may decrease the pain, they may also increase the effects of the toxin. Do not allow the ingestion of foodstuffs. The patient should be advised against smoking. Transport the patient to a medical treatment facility as soon as possible. Exercise caution regarding placement of the arm if the patient is being moved by a stretcher. If the bite is on the hand or arm, it may already be swelling and the stretcher straps would increase the pressure and possibly cut off circulation. Send a description of the reptile along with the patient.

d. **DO NOT** apply ice to the bite. **DO NOT** place a constricting band on the extremity. **DO NOT** apply suction to the bite. Applying any of these techniques has been proven to be of no benefit and will actually increase problems associated with a snakebite.

e. Perform a fasciotomy **ONLY** if there is evidence of vascular impairment. This can be done only by a physician.

f. Administer anitvenom when indicated for crotalid evnvenomation. It is recommended within 6 hours of envenomation. Give four to six vials mixed with 10 mL sterile water for injection. It can take 10 to 30 minutes to mix the vials by rolling them. Do not shake the vials to mix them. See Appendix A for additional information on antivenoms.

g. Infuse the vials at a rate of 25 to 50 mL per hour for the first 10 minutes, then increase to 250mL per hour rate after this.

1-10. PREVENTION OF REPTILE BITES

The following information will help you avoid the painful experience of a snake bite and can save your life.

a. If you cannot see into an area, never place your hands or feet there. Always look before putting your hands or feet anyplace.

b. Make sure your hands are out of the striking distance of any snake that might be underneath a rock or fallen tree before turning it over.

c. Look under fences carefully before crawling beneath them.

d. Look about carefully before sitting down on a log.

e. Gather firewood before it is dark.

f. Do not choose a place near wood or rubbish piles, at the entrance to a cave, or near swampy areas when you are ready to sleep.

g. Never disturb snakes or try to kill them unless it is necessary.

h. Unless you are very skilled at capturing snakes, don't attempt it.

i. Freshly killed snakes are still dangerous, so do not handle them.

j. Attempt to identify a snake without getting within the snake's striking distance.

k. Wear boots at night in any endemic area. Never use low cut shoes in any rattlesnake haunt.

l. If certain waters are known to be infested with snakes, do not swim there.

m. Never examine supposedly dead snakes with your hands, use a stick instead.

n. When transporting a dead snake, place it on the opposite end of a stick.

o. Rattlesnakes can climb trees, so maintain vigilance at high altitudes as well as on the ground.

p. Stay on hiking paths and avoid tall grass and heavy under-brush.

q. Use caution when climbing up cliffs, between rocks, and over boulders.

r. Travel with another person in snake-infested areas.

s. Use the open ground to make camp.

t. When moving tree limbs in or near swampy areas, be cautious. Snakes are known to sun themselves in these areas.

u. If your boat is left on shore for several hours, inspect it carefully before moving it out.

v. Do not "play around" with or near snakes.

w. If the snake bites you, get away from it as quickly as possible.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. A snake will avoid people usually unless it is _____, _____, or _____, and in those cases, it will defend itself.

2. Snakes tend to display more aggressiveness during their _____.

3. The two lizards of the Helodermatides family are the _____ and the _____.

4. How are the lizards of the Helodermatides family unique?

   _____

5. Where can the lizards of the Helodermatides family be found?

   _____

6. Snakes belonging to the Family Elapidae include the_____, _____, _____, _____, and _____.

7. _____ are relatively small snakes and their secretive and burrowing habitskeep contact with humans rather rare and bites even rarer.

8. The coral snakes found in the U.S. are the _____ coral snake, the _____ snake, and the _____ coral snake.

9. The venom of the coral snake is predominantly _____ and is _____.

10. Rattlesnakes are relatively heavy _____, have broad _____, and are marked with _____ over the back.

11. In addition to rattlesnake, some common names of snakes in the family Crotalidae are _____, _____, _____, _____, and _____.

12. _____, _____, and _____ are classified as pit vipers.

13. How did the pit viper get its name?

    _____

14. What is the habitat of the rattlesnake?

    _____

15. Is the rattlesnake easily identified? How?

    _____

16. Where is the water moccasin (cottonmouth) usually found?

    _____

17. How did the cottonmouth derive its name?

_____

18. Where is the copperhead found?

_____

19. Describe the copperhead.

_____

_____

20. Where is the coral snake (Micrurus) found?

_____

21. The coral snake (Micruroides) is located in _____ and the southwest top of _____.

22. How can one identify the U.S. coral snake from a harmless snake?

_____

23. Where does the coral snake usually bite its victim? Why?

_____

_____

24. The poison injected by the coral snake is _____ and affects the victim's cranial nerves.

25. The Gila monster and Mexican beaded lizard can be found in areas from southern _____ to the southwestern part of _____.

26. Most venoms are either primarily _____ (poisonous to the nervous system),such as the venom of the coral snake; or _____ (poisonous to the circulatory system), such as the venom of the rattlesnake.

27. In some _____ percent of snakebites, there is no venom injected.

28. When hemotoxic venom is injected, there is usually a _____, _____ swelling at the site of the bite and it is so severe that it may spontaneously _____.

29. When neurotoxic venom is injected, there is little swelling but the victim suffer _____ in the area of the bite.

30. What is the first aid for snakebite?

    a. _____.

    b. _____.

    c. _____.

    d. _____.

31. The severity of the symptoms of snakebite depends on _____ _____ and whether it was injected into _____ or into _____ or _____ tissue.

32. List the steps in the treatment of reptile bites.

_____.

_____.

_____.

_____.

_____.

_____.

33. Should attempt to cut and suction the wound of a suspected envenomation?

a. Yes.

b. No.

34. List five preventive measures that can be taken to prevent snakebite.

a. _____.

b. _____.

c. _____.

d. _____.

e. _____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES: LESSON 1

1. injured, trapped, or somehow disturbed. (para 1-1)
2. breeding season. (para 1-1)
3. Gila monster and beaded lizard. (para 1-2a)
4. They have grooved teeth and venom glands. (para 1-2a)
5. In the southwestern part of the U.S. and in Mexico. (para 1-2a)
6. Cobra, mamba, krait, coral, and venomous snakes of Australia. (para 1-2c)
7. Corals. (para 1-2c)
8. Eastern, Texas, Arizona or Sonoran. (para 1-2c)
9. Neurotoxic and potent. (para 1-2c)
10. Bodied, heads, blotches or cross bands. (para 1-2e)
11. Moccasins, new world pit vipers, bushmasters, massasaugas and pygmy rattlesnakes. (para 1-2e)
12. Rattlesnakes, moccasins, and copperheads. (para 1-3)
13. From the deep pit between the eye and nostril on each side of the head. (para 1-3)
14. It lives in dry desert areas, grassy plains, forests, and in rocky areas. (para 1-4)
15. Yes, by its rattles. (para 1-4)
16. In the southern Mississippi Valley states eastward to Florida. (para 1-4b)
17. When the cottonmouth becomes excited, it coils its head back with its mouth open to reveal the white inside. (para 1-4b)
18. In the eastern half of the U.S. from Texas to the east coast. (para 1-4c)
19. Its length is from 2 to 4 feet long and its head is the color of copper or reddish brown with an hourglass shape on its back. (para 1-4c)
20. Mainly in the southern states and northward along the Mississippi Valley to Indiana. (para 1-5)

21. Arizona, New Mexico. (para 1-5b)

22. Remember this, "Red on yellow, kill a fellow; red on black, venom lack." (para 1-5b)

23. On the victim's hand, foot, or finger. It has a small mouth and limited jaw expansion. (para 1-5b)

24. Neurotoxic. (para 1-5b)

25. Arizona, New Mexico. (para 1-6a)

26. Neurotoxic, hemotoxic. (para 1-7a)

27. Twenty. (para 1-7c)

28. Rapid, voluminous; burst the skin. (para 1-7c)

29. Paresthesia (numbness) (para 1-7d)

30. To reduce the circulation of blood through the bitten area.
To delay absorption of the venom.
To prevent aggravation of the local wound.
To sustain respiration. (para 1-8)

31. The amount of venom injected; blood vessel; muscle or fatty. (para 1-9)

32. Immobilize the affected part.
Keep the patient calm.
Obtain positive identification of the reptile if you can do so safely.
Do not give the victim any alcoholic beverages, stimulants, or sedation.
Do not apply ice, constricting band, or suction to the wound.
Transport the patient to a medical treatment facility as soon as possible. (para 1-9a-d)

33. b (para 1-9e)

34. Stay on hiking paths and avoid tall grass and underbrush.
Use the open ground to make camp.
Gather firewood before it is dark.
Look under fences carefully before crawling beneath them.
If you cannot see into an area, never place your hands or feet there.
Always look before putting your hands or feet any place. (para 1-10)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	Bites and Stings
TEXT ASSIGNMENT	Paragraph 2-1 through 2-28.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

2-1. Identify the characteristics, signs/ symptoms, and treatment for black widow spider and brown recluse spider bites.

2-2. Identify the characteristics, signs/ symptoms, and treatment for various types of insect stings and bites.

2-3. Identify the various types of injuries from marine life and the emergency treatment for each.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

BITES AND STINGS

Section I. SPIDERS

2-1. GENERAL

In the continental United States (CONUS), insect bites and stings from venomous arthropods may result in severe reactions that can cause death. Arthropods most frequently reported as responsible for bites and stings are wasps, bees, ants, spiders, and scorpions. In certain geographical locations in CONUS, some arthropods have only seasonal importance while others are present throughout the year. Because of the potential for arthropod poisoning to humans, their identification, distribution, behavior, and control are important factors in the prevention of bites and stings.

2-2. CHARACTERISTICS OF THE BLACK WIDOW SPIDER

The black widow spider (figure 2-1) is found in practically all parts of the western hemisphere and has been recorded at an altitude of 8,000 feet in Colorado. It is known as the "hourglass" spider since it has a reddish hourglass figure found on the underside of its abdomen. It may be referred to as the "shoe button" spider also since its abdomen is globose and likened to a shoe button. The adult female is easily identified by its jet-black color and short almost microscopic hairs. It can be found in shady, cool areas (in grass, shrubs, rock and brush piles, latrines, vacant rodent burrows, hollow stumps, and similar places). The female black widow's abdomen is approximately 1/4" long and its overall length is 1.5 inches with its legs extended. The male is somewhat smaller. The male and immature females are gray in color and variously striped and spotted. The venom from a black widow bite is more virulent per unit than that of a rattlesnake. Although all spiders are not considered poisonous to man, all spider bites must be considered serious wounds.

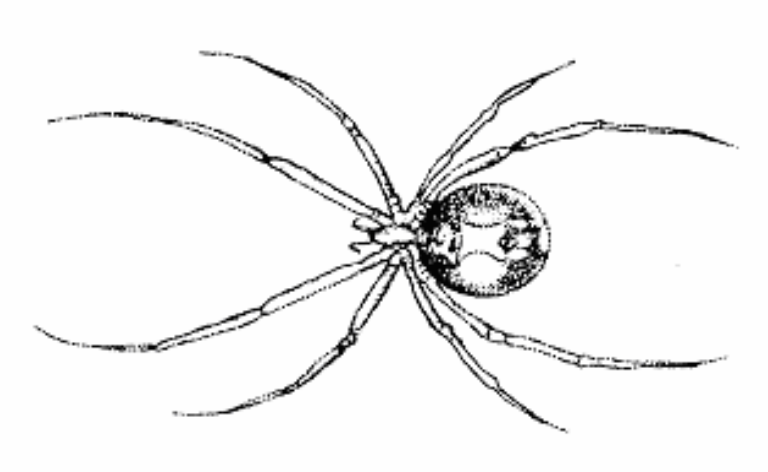


Figure 2-1. Black widow spider (bottom view).

2-3. SIGNS AND SYMPTOMS OF A BLACK WIDOW SPIDER BITE

Although the black widow spider bite may not be felt immediately, there is soon a dull, numbing pain at the bite site where two red puncture marks appear with only a slight local topical reaction. The nervous system is affected, especially the abdominal pain (cramps, 15-20 minutes later). The abdomen is rigid and board like. The victim experiences tightness in the chest with pain during inhalation and he has possible convulsions, paralysis, or signs of shock. In most cases, the symptoms wane without treatment after 2 to 3 days. The bite seldom causes death if treated properly; but it can cause death, especially in children or the elderly. Death usually results from asphyxia by respiratory paralysis.

2-4. TREATMENT FOR A BLACK WIDOW SPIDER BITE

Although the bite is self-limiting, the suffering justifies consideration. Remove the victim's clothing and/or shoes to the extent necessary to expose the bite area. Remove jewelry as soon as possible to prevent restricting the circulation as swelling (edema) occurs. Cleanse the bite area and treat the points of puncture with iodine. Keep the patient as quiet as possible and monitor his vital signs. Apply an ice pack to the bite area (if possible) since the ice relieves pain and swelling and slows down circulation, restricting the spread of the venom. Warm baths or applications may aid in lessening the pain from muscle spasms and some of the undesirable after effects. Administer 10 ml of 10 percent calcium gluconate IV or IM and determine if the victim needs a tetanus booster inoculation. Analgesics and sedatives, such as opiates and barbiturates, are usually not sufficient to overcome muscular pain. There is an antiserum available and is being used in some areas. Treat for anaphylactic shock, if necessary.

2-5. PREVENTION OF BLACK WIDOW SPIDER BITES

To prevent suffering from these bites, keep basements, garages, and the spiders known habitats clean. Be especially careful if you are using an outside privy because many individuals have been bitten on their genitalia while using a privy. Watch for the female spider with her web and egg sacs. When guarding the egg sac, she is particularly prone to biting.

2-6. CHARACTERISTICS OF THE BROWN RECLUSE SPIDER

The recluse spider (figure 2-2) is approximately 3/8" long and is differentiated from other brown spiders by a dark brown violin shaped area on its back. The spider can be found in at least 13 southern and central states to the west coast of the U.S. while other species are found in South America. Its most distinguishing feature is its six eyes, because most spiders have eight eyes.

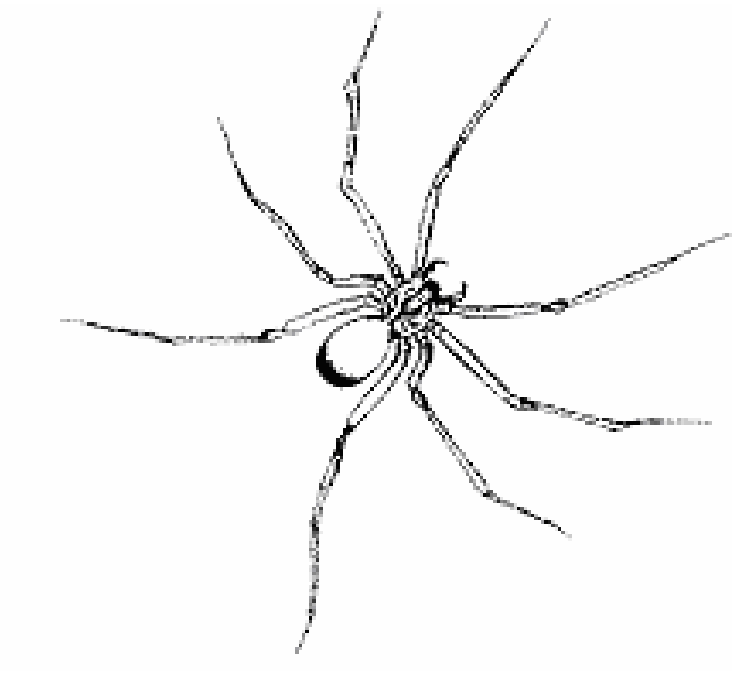


Figure 2-2. The brown recluse spider (top view).

a. The brown recluse seeks the same hiding places the black widow finds to live, that is, shady, hidden areas such as grass, weed shelters, rocky bluffs, and rock piles. It is also found in blankets, shoes, and clothing; however, few people are ever bitten by this nocturnal and retiring spider.

b. The venom injected by the brown recluse spider generally causes a gangrenous mass of dead tissue at the site of the bite and a severe reaction affecting the body as a whole may also occur. A mild, stinging sensation is felt at first, but pain may occur from 2-8 hours after the biting occurred. The venom injected by this spider is hematoxic in that it affects the blood system. Occasionally a severe systemic reaction occurs which affects the entire body system.

2-7. SIGNS AND SYMPTOMS OF BROWN RECLUSE SPIDER BITES

The victim experiences a mild transitory stinging at the time of the bite but has little associated pain. He is restless and has fever with flu-like symptoms. It is possible that a rash similar to scarlet fever will develop but the patient may be unaware of being bitten and the spider is seldom seen. Within 2 to 8 hours after the bite, pain ensues that is mild to severe and an ulcer may form at the site of the bite after several days. Necrotic tissue at the bite site may develop and become so severe that eventual skin grafting may be required. Occasionally, the patient may suffer severe systemic reactions or hemolytic syndrome.

2-8. TREATMENT OF BROWN RECLUSE SPIDER BITES

Death seldom results from the bite of this spider when proper measures are administered in time. It is necessary to pack the site of the bite with crushed ice for 6 to 8 hours to keep the venom from spreading rapidly. Keep the patient warm to the point of perspiration and force fluids into him. The treatment is much the same as for a pit viper bite, but for a much shorter period of time. The venom injected by the recluse spider is not really a toxin, but a complete chemical that inhibits the normal action of the infection-fighting antibodies in the human anatomy. Ten to 50 mg IV of Benadryl may be given for the first 24 hours; for acute reaction, a medical officer can give up to 300 mg of Benadryl IV. The wound can be especially dangerous when the wound edges become black and purple (necrotic). The area sloughs in a few days to a week and leaves a deep, sharply defined granular area that is surrounded by the raised edge of healthy tissue. This area becomes quite large and may persist for several weeks while the healing slowly takes place. One case was cited where the wound failed to heal and it was ultimately necessary to perform a skin graft. There have been two cases reported where the brown recluse spider bite was fatal. If the victim is bitten on his fingers or toes, there is a good possibility that the appendage will be lost.

2-9. TARANTULAS

Tarantulas are any of the various large hairy spiders (family Theraphosidae) that are typically rather sluggish. Early immigrants brought to the Western Hemisphere had an unreasoning fear of spiders and the name "Tarantula." The tarantula, known to nature as bird spiders, are nearsighted and their sharp fangs can inflict a painful bite, but they seldom use them. They will bite only in defense against human molestation. The treatment for the tarantula bite consists of an application of iodine or similar antiseptic. The males are commonly encountered while traveling across the country and are particularly noticeable as they cross highways when they migrate during the mating season. They are of benefit to man since they prey upon insects and should be protected rather than molested or killed.

Section II. INSECTS

2-10. INSECT STINGS AND BITES

Some insects that are not involved in disease transmission are nonetheless medically important because of the painful and sometimes poisonous effect of their stings. Bees and wasps fit into this category.

2-11. BUMBLEBEES AND HONEYBEES

Both sets of these bees are social bees having a worker caste along with fertile males (drones) and females (queens).

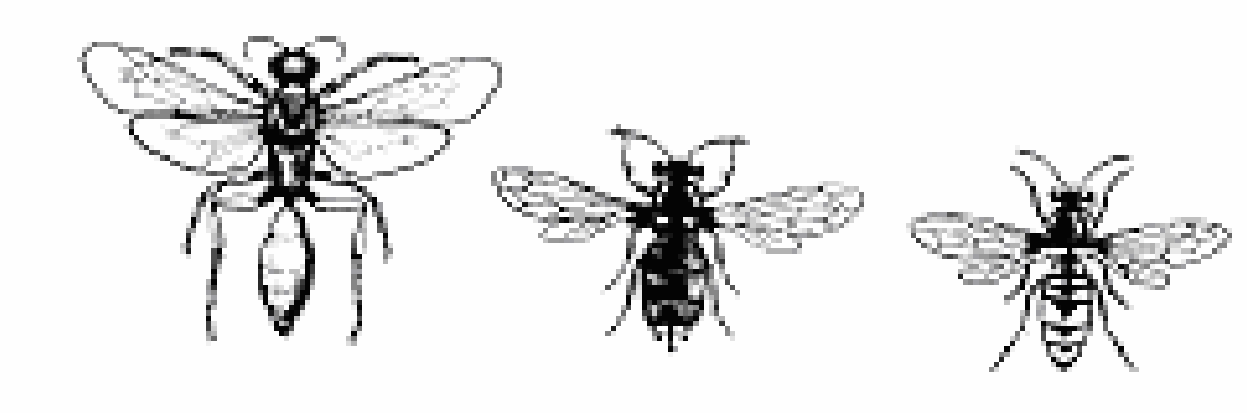
a. In the bumblebees' temporary colony, only the fertilized young queen survives the winter. When springtime comes, the young queen locates a place to find her colony; her nest is usually associated with the ground. Generally, the nest is found in a deserted rodent burrow; however, nests may be found in buildings and other structures that have suitable soft materials. An individual who is working or hiking in a field where bumblebees are nesting could unwarily step into the nest and be stung severely.

b. The honeybee (figure 2-3) forms permanent colonies that survive from year to year indefinitely. This social colonial hymenopterous insect (Apis mellifera) is usually kept in hives for the honey and wax that it produces. A honeybee differs from the related wasp especially in the heavier, hairier body and in having sucking as well as chewing mouthparts that feed on and store pollen and nectar. The honeybee has a rounded abdomen and, when it stings, its stinger remains in the victim. The bee will fly away and die. On the other hand, a wasp, hornet, and yellow jacket (slender body with elongated body) retain their stingers and can sting repeatedly. The venom from the honeybee is a water-clear liquid having a sharp, bitter taste and it can incur neurotoxic, hemorrhagic, or hemolytic damage. The severe reactions to bee stings are usually caused by sensitivity to bee protein, not the venom. If the victim has reactions other than local swelling or irritation, consult a physician for immediate treatment and long-term desensitization.

Figure 2-3. Honeybee.

2-12. WASPS, YELLOW JACKETS, AND HORNETS

Wasps (figure 2-4) are classified as any of the numerous social or solitary winged hymenopterous insects that usually have a slender, smooth body with the abdomen attached by a narrow stalk, well-developed wings, and biting mouthparts. Yellow jackets are any of the various small yellow-marked social wasps (family Vespidae) and hornets are any of the larger social wasps of the family Vespidae. Hornets usually build nests of pulp by masticating wood fiber. These nests can be found in hollow trees or among branches of trees. Some hornets build nests under the eaves of houses or in holes somewhere near the ground. A hanging nest may reach 9 to 10 inches in diameter. The old colony dies out in the summer or in the fall and the young fertilized queen starts a new nest in the spring. Some species form paper dwellings containing a single horizontal comb or hexagonal cells attached to support by a pedicel. Still other species build small nests of mud and place insects and spiders in them as food for the larvae. This type of nest may be found in outbuildings and in attics.



.Figure 2-4. Wasp, hornet, and yellow jacket.

2-13. CHARACTERISTICS OF BEE, WASP, HORNET, YELLOW JACKET STINGS

Stings are not necessarily dangerous but in rare cases, a victim may be so allergic to this type of injury that a single sting may result in death. In a case where death occurs, it is caused by severe allergic reaction leading to respiratory arrest and shock. This same reaction may occur in patients who have sustained multiple bee or wasp stings. More deaths occur annually from bee and wasp stings than from snakebites. Death is caused by hypersensitive reaction (anaphylactic shock).

2-14. SIGNS AND SYMPTOMS

The victim experiences pain and inflammation at the sting site and a wheal may develop. Swelling around his eyes and mouth is possible and he may show some anxiety and itching at the site that represents a mild reaction. If the victim experiences wheezing, vomiting, dizziness, abdominal pain, tightness in the chest, and generalized edema, he is having a moderate reaction to the sting. If the victim shows signs of labored breathing, difficulty in swallowing, and confusion, he is having a severe reaction. Watch the victim for signs of shock and treat immediately.

2-15. TREATMENT

This entire group of arthropods stings their victims and often leave the stinger and venom sac imbedded in the skin. Remove the stinger by gently scraping it with a fingernail, a blade, or other thin metal object. Removal prevents further venom injection from the venom sac. DO NOT PULL the stinger out because this action releases more venom. Do not rupture the venom sac if at all possible. Toxins from this group are similar to the venom of viperine snakes in having a hemolysin factor, but their primary effect seems to be the strong histamine they contain. A previous history of being stung by any of the group does not necessarily mean that an individual cannot have a moderate to severe reaction from stings at a later time in life. Wash the sting site with soap and water and apply an ice pack or a solution of 10 percent ammonia. A systemic reaction within 20 minutes after the sting means a threat to the patient's life and it is necessary to get to the victim as fast as possible. Treat patients that have mild constitutional reactions if they occur within an hour. Time is a critical factor when a victim reports a systemic reaction to an insect sting. If he has any symptoms in addition to the local reaction, or even if he has a severe local reaction to a sting on the face or neck developing within 20 minutes of the sting, administer epinephrine (Adrenalin, Asmolin) as rapidly as possible. If the patient reports an onset of mild symptoms of a constitutional reaction between 20 minutes and an hour after being stung, the urgency of treatment is not so great, though the patient should be seen and treated with epinephrine. The shorter the interval between the sting and the development of symptoms of a systemic reaction, the greater the risk.

2-16. PROPHYLAXIS

Patients who have suffered systemic or increasingly severe local reactions should carry emergency treatment kits. Hyposensitization is a must for those who have had constitutional reactions and it is advised for some with severe local reactions. Patients should take measures to avoid being stung if at all possible and should wear an emergency ID device apprising others in case this is needed. Victims known to have a sensitivity to Hymenoptera venom should avoid places where stinging insects are located (camp and picnic sites); stay away from the insect's feeding ground (flowers, fruit orchards, garbage, clover fields); refrain from going barefoot outdoors since yellow jackets nest on the ground; do not use perfume, scented soap, or bright colors because these items attract bees; keep the car windows closed when traveling; use rapid-acting insecticide to spray garbage cans; hire a professional exterminator for wasp/hornet nests or bee hives in the home area; and consider undergoing immunotherapy with venom extract.

2-17. LOCAL CUTANEOUS TREATMENT

The application of any of the following will help to soothe the area that has been stung: local compresses, a baking soda solution or paste of soda bicarbonate, strong household ammonia to reduce discomfort, Benadryl 4 kg/BW, and 10 ml of calcium gluconate 10 percent by IV.

Section III. FIRE ANTS, SCORPIONS, CENTIPEDES, AND MILLIPEDES

2-18. FIRE ANTS

These ants are referred to as fire ants because of the sharp, fiery pain accompanying their stings. It is believed they were introduced into the United States as cargo stowaway prior to 1930 and since then have become a scourge throughout the southwestern states. They are spreading rapidly, probably as passenger car stowaways now. This ant (figure 2-5) is 5 to 6 mm long and its color depends upon its geographical area where it is located. The fire ant is known for the suddenness and ferocity of its attack when a nest (a large hard-crusted earthen mound) is disturbed. It sinks its powerful mandibles into the victim's skin for leverage and drives its sting into the flesh.

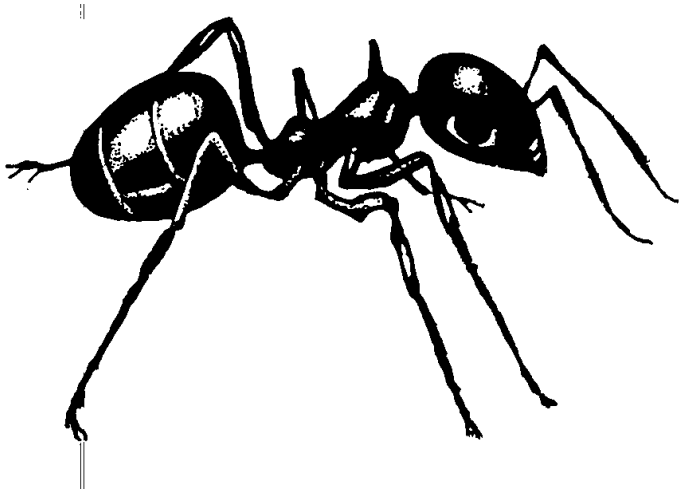


Figure 2-5. Fire ant.

2-19. SIGNS AND SYMPTOMS OF FIRE ANT STINGS

Immediately upon the fire ant's preparation, the victim experiences a fierce, burning pain. A wheal develops at the site some 4 to 8 mm in diameter and it is possible to detect two bright hemorrhagic punctures. The superficial vesicles containing thin, clear liquid within 24 hours develops into an umbilicated pustule enclosed in a red halo that is very painful. Possessing neurotoxic and hemolytic properties, the venom injected by the fire ant is water-insoluble, strongly alkaline, and soluble in most organic solvents. The victim may show febrile and allergic symptoms. Fatalities have been reported.

2-20. TREATMENT OF A FIRE ANT STING

No local treatment has been found effectual for the fire ant sting, so the treatment to be administered is the same as for a bee sting. Administer Benadryl 4 mg/kg/Bw, and an IV of 10 ml of 10 percent calcium gluconate.

2-21. CHARACTERISTICS OF SCORPIONS

The scorpion's sting is both hemolytic and neurotoxic. In most areas of the world, scorpions are not highly dangerous. However, in South America, Mexico, the Middle East, and in some parts of North America, certain types can cause death if proper measures are not administered. The scorpion (figure 2-6) is easily identified by its crab-like appearance and its long, fleshy tail-like post abdomen that terminates in a bulbous sac and the stinger at the very end. The sting curves upward if the tail is extended; downward if the scorpion poises for attack or defense. The nocturnal scorpion is commonly found in warmer climates. It remains hidden during the daytime beneath loose stones, loose bark of fallen trees, under piles of lumber, out- building floors, or in shoes. Some scorpions bury themselves in loose earth. Its food consists of insects, spiders, millipedes, and even small rodents.

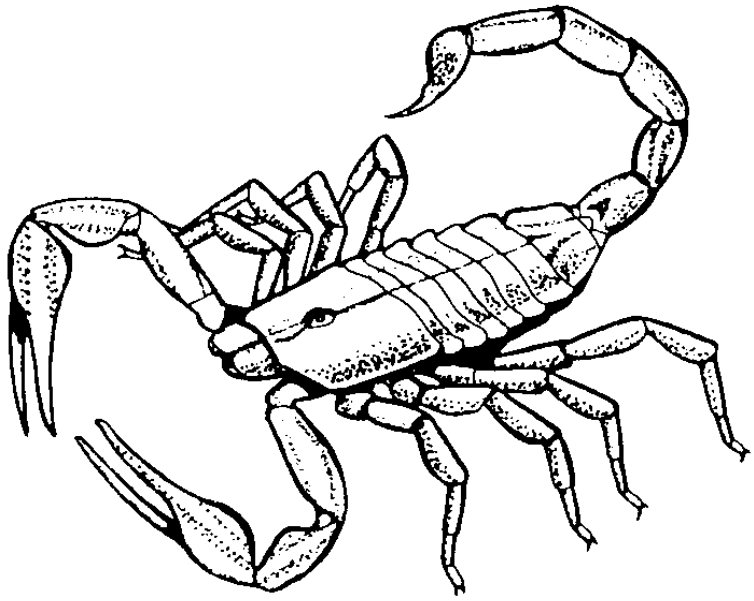


Figure 2-6. Scorpion.

2-22. INCIDENCE AND IDENTIFICATION OF SCORPIONS

The greatest danger of scorpion stings is to small children under the age of four years. Unless prompt action is taken, a small child might be killed by the poison from a single sting from one of the deadly species of scorpions. The scorpion attacks over the top of itself. The pincers at the head are used to hold the prey, while the scorpion tears the prey to pieces with its jaws. Any victim is struck quickly and repeatedly as the scorpion whips its tail over its body to sting.

2-23. SIGNS AND SYMPTOMS OF SCORPION STINGS

When stung by a scorpion, the victim experiences intense pain at the site of the sting. There is very little inflammation, but there is swelling and numbness at the site at first. The inflammation may increase to a state in small children that they become entirely unable to cooperate with attendants. There is progressive swelling and redness at the sting site and the victim has peripheral nervous system excitement. The victim may go into shock, experience drowsiness, seizures, muscle spasms, vomiting, severe thirst, and terminal bradycardia. These are the symptoms of a sting by the deadly Durango scorpion (found in the state of Durango, Mexico). Following the sharp pain, there is a feeling of numbness or drowsiness immediately followed by an itching sensation in the nose, mouth, and throat. The victim must necessarily distort his face to rub his nose and mouth or to sneeze. At first, it is similar to having a ball of hair in his throat. This sensation induces the victim to swallow as rapidly as possible. His tongue becomes sluggish and he must signal to make any communication with others. The contraction of muscles of the lower jaw makes it difficult or impossible to administer medications through the mouth. He has a disorder of movements in his arms and legs and his temperature rises rapidly to 104º or 104.8ºF. Along with this, the salivary secretion diminishes and his urine becomes scarce. His senses of touch and sight are affected and strong light is very unpleasant. There may be pronounced strabismus. He may experience hemorrhaging of the stomach, intestines, or lungs with convulsions coming in waves and increasing in severity for an hour and a half to two hours or until it is fatal. If the victim survives for three hours, he can usually be considered out of danger, but death may occur six to eight hours after the sting (death probably due to nervous exhaustion after the long periods of convulsions). The victim of a scorpion sting should be taken to a physician who has had experience with these stings, especially if the victim is under five years old, has a heart ailment, or was stung on a number of widely distributed places or on his face, back of the neck, or genitalia. There is anti-scorpion serum available for the most dangerous scorpion stings.

2-24. CARE AND TREATMENT OF SCORPION STINGS

Usually the sting is no more serious than a good size wasp sting and the corrective measures are similar. Keep the patient quiet, and do not incise or suction the sting. Apply a tight tourniquet as close as possible beyond the site, apply a paste of baking soda to relieve the pain and give specific antivenin to severely ill or victims under 14 years old. Administer 10 ml IV of 10 percent calcium gluconate for the relief of muscle pain and repeat as needed. If the pain is severe, give the victim barbiturates (orally, 30-60 mg) because they are more effective and less dangerous than morphine. The victim can be sedated with Thorazine 25 mg by mouth 4 times a day or 25 mg IM qd or Solucortef 1 gm IV. Place ice or some type of freeze-pack on the site of the sting as soon as possible since this may decrease the absorption of the poisonous venom by the body. It may be used up to two hours but do not let the ice freeze the area. If a hand or foot has been emerged in ice water, remove it for one minute after 15 minutes and thereafter repeat this procedure every 10 minutes. Do not use the iced water immersion if the victim has a disease of the extremities involving circulation.

2-25. CENTIPEDES

Wormlike in form, centipedes have a distinct head with a pair of antennae and many fairly similar body segments, each with one pair of segmented appendages. They are like insects being tracheated and for the most part, terrestrial. The centipede's body segments are somewhat flattened so that a cross section of one of them is oval. Its 15 to 100 pairs of legs are moderately conspicuous and in spite of the confusing number of walking appendages, centipedes crawl very rapidly. Most of them feed mainly on insects. They have powerful poison claws that are located immediately ventral to the mouth and connected by means of a hollow tube to large poison glands. These claws are the appendages of the first body segment behind the head. They are able to quickly kill large insects with their poison claws that close upon the insects. Probably the worst a centipede can be expected to do to humans is to inflict severe local pain similar to the sting of a hornet. The treatment consists of applying cold compresses, and administering aspirin for pain. Treat to prevent secondary infection. One record of a fatal centipede bite was that of a 7-year-old child who succumbed 29 hours later after being bitten on the hand.

2-26. MILLIPEDES

Millipedes are different from centipedes since the millipedes' most apparent body segments possess two pairs of appendages instead of one. Millipedes also do not have two poisonous fangs that are characteristic of centipedes. The millipedes' (in most species) body has a cylindrical shape, and the numerous legs and antenna are short and inconspicuous. The North American millipedes have glands that produce irritating effects (this is true with the exception of one of the species). Some species are capable of squirting an irritating fluid for several inches while one of the Haitian species can direct its secretion some 28 to 33 inches. This secretion may cause blistering of the victim's skin or chemical burns to the eyes. Treat the skin by washing it with soap and water. Flush the victim's eyes with water and apply a bandage. It is important to keep the millipede's secretion away from one's eyes because the fluid is extremely dangerous in this area and can produce blindness.

Section IV. INJURIES FROM MARINE LIFE

2-27. MARINE LIFE

There are over one thousand species of marine animals that are poisonous to eat or are capable of inflicting injury upon humans. Actually, there are only six major types of injury mechanisms. Trauma from bites and lacerations, stings from tentacles, puncture from spines, poisonous bites from fangs, poisoning by ingestion, and miscellaneous injuries such as shock and skin rashes. Usually, emergency treatment results in a definitive cure with the exception of fish poisonings. Complications may arise, however, so anyone receiving an injury from a marine animal should receive follow-up care by a physician. Injuries from marine animals are uncommon since these animals are not usually aggressive. In cases where the patient has swum into the tentacles of a jellyfish, stepped on a stingray, or fallen onto a sea urchin, there is a self-inflicted injury. Additional emergency supplies should be available in those areas where marine animal injuries are likely to occur. Some items are quite out of the ordinary for treatment, for example, bottle of meat tenderizer, drying powders such as talcum or flour, a spatula or knife blade, and water heating arrangements (pan and can of Sterno). If the victim has eaten a poisonous fish, further treatment may be required.

2-28. DIAGNOSIS AND EMERGENCY TREATMENT OF MARINE ANIMAL INJURIES

As a Medical NCO, you should familiarize yourself with unusual marine animals in the area and be prepared to treat victims and administer antivenins for injuries inflicted by these marine animals.

a. **Trauma from Bites and Lacerations.** In the treatment for major wounds caused by a shark, barracuda or alligator gar, take measures to control bleeding, prevent shock, give basic life support, splint the injury, and secure prompt medical care. The possible complications from this type of injury are shock and infections. For the treatment for minor wounds caused by a moray eel, turtle or corals, it is necessary to cleanse the wound and splint the injury.

b. **Sting by Tentacles.** This type of wound may be caused by a jellyfish, Portuguese man-of-war, anemones, corals, or hydras. The cause for the intense burning pain that occurs from the sting of the jellyfish is from nematocysts (stinging cells) found on the jellyfish's tentacles. For several days, these cells remain potent when the sea creature is washed up on shore. Treatment is usually self-directed and symptomatic relief. There are many home remedies and most do not work, some even cause further harm. The best treatment is to wash the affected area with warm soapy water to apply symptomatic relief of pain and itching by the use if antihistamines and analgesics. After the powder dries the area, the stings will stick together and you can remove the stings by scraping the area. The complications from this type of wound may be allergic reactions or respiratory arrest. An alternate treatment is the use of hot water as explained in the following paragraph.

c. **Puncture by Spines.** Punctures may be caused by contact with urchins, cone shells, stingrays, or spiny fish (catfish, toad, or oyster fish). To treat this type of wound, it is necessary to inactivate the area with hot water since the foreign material or poison introduced into the wound is heat-sensitive. If possible, soak the area in quite hot water for thirty to sixty minutes, but be careful not to scald the victim. He will not be able to judge the temperature of the water since the wound excruciatingly painful. The possible complications from this type of wound could be allergic reactions, collapse, infections, tetanus, or granuloma formation.

d. **Poisonous Bite by Fangs.** In case of bites from a sea snake or octopus, give basic life support. The blue-ringed octopus of Australia has inflicted fatal bites, but this is the only species known to do this. The possible complications from the poisonous bite are paralysis, myoglobinuria, or respiratory arrest.

e. **Poisoning by Injection.** If this type of poisoning is suspected, refer to Halstead's Poisonous and Venomous Marine Animals of the World and contact a poison control center. The fish involved include the puffer fish, scromboids (tuna species), ciguatera (large colored fish), and paralytic shellfish. Give basic life support and prevent self-injury from convulsions. The possible complications from this type of injury are allergic reactions, asthmatic reactions, paresthesia, numbness, temperature reversal phenomena, or respiratory arrest and circulatory collapse.

f. **Miscellaneous Injuries.** Shock and skin rashes are examples of miscellaneous injuries. The electric fish and marine parasites may cause these types of injuries. No treatment is required since the injury is usually self-limiting. The most likely complication is that the shock from an electric fish or electric eel may precipitate a panic reaction.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Insect bites and stings from venomous arthropods may result in severe reactions or even _____.

2. Arthropods most frequently reported as responsible for bites and stings are _____, _____, _____, _____ , and _____.

3. The black widow spider is often referred to as the _____ spider.

4. The black widow spider lives in _____, _____ places.

5. The male black widow spider is _____ in color.

6. The venom from a black widow spider bite is more _____ than that of a rattlesnake.

7. After the bite from a black widow spider, _____ are visible.

8. A black widow spider bite affects the _____.

9. Death from a black widow spider bite usually results from _____ by respiratory paralysis.

10. After a black widow spider bite, it is necessary to remove the victim's jewelry as soon as possible to prevent _____.

11. The brown recluse spider is differentiated from other brown spiders by a dark brown _____ on its back.

12. Most spiders have eight eyes; therefore, the _____ eyes of the brown recluse spider is another distinguishing feature.

13. The venom injected by the brown recluse spider is _____ in that it affects the blood system.

14. After the bite of a brown recluse spider, it is possible that a _____ will develop, but the victim may be unaware of being bitten and the spider is seldom seen.

15. _____ tissue at the brown recluse spider bite site may develop and become so severe that eventual skin grafting may be required.

16. Apply _____ at the site of the brown recluse spider bite for 6-8 hours to keep the venom from spreading rapidly.

17. The venom injected by the brown recluse spider is not really a toxin, but a complete chemical that inhibits _____.

18. If the victim is bitten on his fingers or toes by the brown recluse spider, there is a good possibility that the appendage _____.

19. The bumblebee's nest is usually associated _____.

20. The three classes of honeybees are the _____, _____, and the _____.

21. The _____ from the honeybee is a water-clear liquid having a sharp, bitter taste and it can incur neurotoxic, hemorrhagic, or hemolytic damage.

22. Severe reactions to bee stings are usually caused by sensitivity to _____, not the venom.

23. _____ usually have a slender smooth body with the abdomen attached by a narrow stalk, well-developed wings, and biting mouthparts.

24. More _____ occur annually from bee and wasp stings than from snakebites.

25. The victim of a bee sting experiences pain and inflammation at the site and a _____ may develop.

26. _____ is a critical factor when a victim reports a systemic reaction to an insect sting.

27. Patients known to have a sensitivity to Hymenoptera venom should avoid places _____.

28. The fire ant is known for the _____ of its attack when a nest is disturbed.

29. Possessing neurotoxic and hemolytic properties, the venom injected by the _____ is water-insoluble, strongly alkaline and is soluble in most organic solvents.

30. Treatment for the fire ant sting is the same as for the _____.

31. The _____ is both hemolytic and neurotoxic.

32. A scorpion is _____ in appearance.

33. The scorpion can sting _____ and _____.

34. _____ have powerful poison claws that are located immediately ventral to the mouth and connected by means of a hollow tube to large poison glands.

35. _____ do not have the poisonous fangs that are characteristic of centipedes.

36. List six types of injuries caused by marine life.

    a. _____.

    b. _____.

    c. _____.

    d. _____.

    e. _____.

    f. _____.

37. Injuries from marine animals are _____ since these animals are not usually aggressive.

38. Injuries from marine life are usually _____ injuries.

39. The treatment for major wounds caused by a shark, barracuda or alligator gar include:

    a. _____.

    b. _____.

    c. _____.

    d. _____.

    e. _____.

40. Puncture by spines from marine life may be caused by contact with _____, _____, _____, or _____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES: LESSON 2

1. Death. (para 2-1)
2. Wasps, bees, ants, spiders, and scorpions. (para 2-1)
3. "Hourglass" or "shoe button" (para 2-2)
4. Cool, shady. (para 2-2)
5. Gray. (para 2-2)
6. Virulent per unit. (para 2-2)
7. Two red puncture marks. (para 2-3)
8. Nervous system. (para 2-3)
9. Asphyxia. (para 2-3)
10. Restricting circulation. (para 2-4)
11. Violin-shaped area. (para 2-6)
12. Six. (para 2-6)
13. Hematoxic. (para 2-6b)
14. Rash similar to scarlet fever. (para 2-7)
15. Necrotic. (para 2-7)
16. Ice packs. (para 2-8)
17. The normal action of the infection-fighting antibodie. (para 2-8)
18. Will be lost. (para 2-8)
19. With the ground. (para 2-11a)
20. Worker, drone, and the queen. (para 2-11)
21. Venom. (para 2-11b)
22. Bee protein. (para 2-11b)

23. Wasps. (para 2-12)

24. Deaths. (para 2-13)

25. Wheal. (para 2-14)

26. Time. (para 2-15)

27. Where stinging insects are located. (para 2-16)

28. Suddenness and ferocity. (para 2-18)

29. Fire ant. (para 2-19)

30. Bee sting. (para 2-20)

31. Scorpion's sting. (para 2-21)

32. Crab-like. (para 2-21)

33. Quickly and repeatedly. (para 2-22)

34. Centipedes. (para 2-25)

35. Millipedes. (para 2-26)

36. Trauma from bites and lacerations.
Punctures from spines.
Poisoning by ingestion.
Stings from tentacles.
Poisonous bites from fangs.
Miscellaneous injuries. (para 2-27)

37. Uncommon. (para 2-27)

38. Self-inflicted. (para 2-27)

39. Take measures to control bleeding.
Prevent shock.
Give basic life support.
Splint the injury.
Secure prompt medical care. (para 2-28a)

40. Urchins, cone shells, stingrays, or spiny fish. (para 2-28c)

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3	Anaphylaxis and Anaphylactic Shock
LESSON ASSIGNMENT	Paragraphs 3-1 through 3-5.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

3-1. Identify the anaphylaxis action mechanism.

3-2. Identify those substances that can cause anaphylactic shock.

3-3. Identify the signs and symptoms of anaphylactic shock.

3-4. Identify the treatment for anaphylactic shock.

3-5. Identify the measures for prevention of anaphylactic shock.

SUGGESTION After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

ANAPHYLAXIS AND ANAPHYLACTIC SHOCK

3-1. INTRODUCTION

When a foreign protein or other foreign substance is introduced into the body, the normal systemic reaction is to throw off the substance. Anaphylaxis is an unusual allergic reaction. It is caused by a hypersensitivity to a specific substance introduced into the body for the second or a subsequent time. Anaphylaxis is never apparent during the first contact with the foreign substance. During the time between the first and second experience with the foreign substance, the person develops antibodies. In a majority of cases, the antibody produced is immunoglobin IgE. When the foreign substance (antigen) makes later contact with the person, there is an antigen-antibody reaction. The body releases a toxic histamine-like substance that causes a mild to lethal reaction. When the reaction is severe, it is called anaphylactic shock. The shorter the time before symptoms appear, the greater the risk of a fatal reaction. Anaphylactic shock is always considered a serious medical emergency.

3-2. SUBSTANCES CAUSING ANAPHYLACTIC SHOCK

a. There are many kinds of substances that can produce anaphylactic shock. These substances may be absorbed from injections, by ingestion, or by inhaling them.

(1) Injections of serums or drugs. Parenteral injections of penicillin are the most frequent cause of anaphylactic shock. If the drug is ingested, the reaction is less rapid than through injection, but will still occur. Tetanus antitoxin is another frequent cause. Some antitoxins and extracts of allergenic substances are formed by using animal serum. When these are used for testing or desensitizing an allergic patient, these can cause anaphylactic shock. Diagnostic medical procedures such as an angiogram or pyelogram use contrast media containing iodide. These media have been known to produce a serious allergic response.

(2) Insect stings. When sudden death results from a bee sting, this is due to anaphylactic shock. Wasps, hornets, yellow jackets, and other stinging insects are also possible causes.

(3) Foods. Shellfish is a frequent cause of anaphylactic shock. Other culprits include other types of fish, milk, and strawberries. Other types of berries can also cause this reaction.

(4) Drugs. Several kinds of ingested drugs can be causes. There have been cases of deaths caused by acetylsalicylic acid (aspirin) as it was absorbed into the blood stream. This drug is not as safe as it was once believed.

(5) Inhaled allergens. If the person is allergic to such substances as animal hair, dust, ragweed or pollens, these can cause anaphylactic shock.

b. People with a history of allergies are more likely to develop anaphylactic problems than those who do not have such a history. The patient should be questioned carefully and any known allergies should be posted on the patient's chart in a manner that is easily visible to anyone who is concerned with patient care. When a serum such as horse, rabbit, or bovine is being considered for injection, the person should be tested for sensitivity. A small amount is inserted just under the skin on the forearm. After a few minutes, the site may produce itching, a red appearance, or a slight rash. These results indicate a positive reaction and the physician must be notified before the considered serum is used.

3-3. SIGNS AND SYMPTOMS

The signs and symptoms of anaphylactic shock occur almost instantaneously. Sometimes they will happen within minutes or even seconds. Less frequently, they may take an hour or more to develop. In many cases, the only immediate reaction is loss of consciousness. In other cases, there will be early feelings of uneasiness or apprehension, general weakness, perspiration, sneezing, or nasal pruritis.

a. **Respiratory Signs.** Sneezing and coughing caused by spasms in the bronchioles may be the first signs. Wheezing will be audible and there is a painful tightness or squeezing sensation in the chest. There will be difficulty in breathing and possible edema of the larynx and/or epiglottis. Cyanosis may also be evident.

b. **Involvement of the Skin.** There may be itching and a sensation of warmth especially near the face and on the chest. This is usually accompanied by a reddening of the skin. If the itching is generalized, a general systemic reaction is beginning. Patches of urticaria (hives) may also appear. The skin may appear pale as the peripheral blood vessels collapse. If massive angioedema occurs on the face, this is caused by the swelling of the blood vessels just underneath the skin. This may indicate upper respiratory edema.

c. **Cardiac and Circulatory Involvement.** The pulse may be rapid or weak or it may not be possible to get a pulse. There is a falling or very low blood pressure. Tachycardia or bradycardia may be apparent. There could be a diminished stroke volume and consequently diminished cardiac output. In fatal cases, a complete circulatory failure leads to a coma and death.

d. **Gastrointestinal Effects.** Nausea and vomiting are common problems. There may be colicky abdominal pains or convulsions. Diarrhea and fecal and/or urinary incontinence may occur.

3-4. TREATMENT

The drug of choice for emergency treatment is aqueous epinephrine, administered parenterally. Epinephrine is the pharmacologic antagonist of the action of chemical mediators (such as histamines) on smooth muscle and other effector cells.

a. **Emergency Treatment.** Quickly assess the condition of the patient. If needed, establish an airway, begin CPR, and administer oxygen, if available. If the reaction is due to an insect sting, a constricting band should be placed above the site of the sting. This is only feasible if the sting is on an extremity. Inject aqueous epinephrine into the upper arm. If glottic edema is present, a cricothyrotomy may provide an airway. If necessary, use closed-chest cardiac massage. When help is available, utilize it. You will need as many skilled hands as possible. Sometimes seconds can make a difference between life and death. Use good judgment in selecting the administration route for epinephrine and other drugs.

(1) For mild generalized symptoms, administer epinephrine subcutaneously.

(2) When reaction is more severe and is getting progressively worse, administer epinephrine intramuscularly or sublingually. This is especially necessary if you are concerned that vascular collapse will slow or stop absorption.

(3) When aqueous epinephrine is administered intravenously, it is diluted with saline and given slowly. This is done for profound hypotension. Care must be taken because this administration route may cause cardiac arrhythmias. If possible, start an intravenous infusion with normal saline or D5W for an emergency route. For insect stings, aqueous epinephrine should also be injected at the sting site.

b. **Secondary Treatment.** In the event that the administration of epinephrine does not stop and reverse the antigen-antibody reaction, it may be necessary to use other methods. Most other drugs act upon one or several specific symptoms of anaphylaxis. Many of those which are listed may be available at the larger medical treatment facilities, but not at field facilities.

(1) Diphenhydramine hydrochloride (Benadryl) or other antihistamines help block systemic histamine effects. These are usually injected intramuscularly.

(2) Aminophylline is used to combat bronchospasm and asthmatic symptoms. If the patient is responding to epinephrine, this is usually not given. Aminophylline is administered intravenously over a period of time. Other intravenous infusions may also be used.

(3) Prolonged hypotension may be treated several ways.

(a) Plasma or colloids (dextran).

(b) Vasoconstrictors, e.g., metraminol bitarate (Aramine) or levarterenol bitarate (Levophed).

(c) Isoproterenol or dopamine for reduced cardiac output.

(4) Diphenhydramine chloride helps prevent laryngeal edema. Administer intravenously.

(5) For convulsions, use intravenous injections of a short-acting barbiturate or diazepam. Administer over several minutes.

(6) If a patient has prolonged laryngeal edema and hypotension, corticosteroids are administered. Even if administered intravenously, these will take one to several hours to act.

c. **Following Emergency Treatment.** Carefully evaluate the emergency treatment. It may be necessary to repeat epinephrine or recommend additional medication. If the reaction is under control, the restrictive band may be removed. Continue to monitor the patient's vital signs and watch for hypotension and any respiratory distress.

3-5. PREVENTIVE MEASURES

Any time you are using a serum with an animal base, extracts which are known to cause allergic reactions, or contrast media containing iodide, you should have epinephrine hydrochloride (Adrenalin) available. An antihistamine, aminophylline, and levarterenol should also be available. The patient should be kept under observation for at least 20 minutes. If a reaction occurs within the first few minutes, there could be a medical emergency. Notify the doctor at the first sign of symptoms such as redness and itching at the injection site, itching eyes, nasal symptoms or a tight feeling in the chest. If there is a slight reaction, the doctor will order an antihistamine by mouth. In a more severe case, the antihistamine is given parenterally and a tourniquet should be applied above the injection site. Adrenalin is frequently injected into the site. Periodic injections of Adrenalin can be given until the reaction begins to reverse or tachycardia develops. Aminophylline may be given to relax bronchial spasm and if the blood pressure is too low, levarterenol can be given. To counteract shock, elevate the patient's legs, start an intravenous flow and give oxygen by positive pressure mask. These are some positive steps that you should take.

a. Watch for anaphylactic reactions.

b. Ask these questions of patients.

(1) Does he have any allergies? If yes, do not give the injection or medications.

(2) Has he had this serum or antigenic agent earlier?

(3) Has he ever had an allergic reaction to food or pollen?

c. If you know the patient has hay fever, asthma, or a like allergic disorder, avoid giving a drug unless absolutely necessary.

d. Injections of any type are more likely to produce an anaphylactic reaction than oral medications.

e. Skin testing should be done before administering a foreign serum, but be aware that the testing itself could cause a reaction. Have epinephrine on hand just in case of a severe reaction. A negative skin test does not always assure complete safety.

f. If a patient is receiving an injection as an outpatient, keep him nearby for at least 30 minutes after each injection, no matter how many times he has received the same type of injection.

g. Advise patients who are sensitive to the stings of insects or other allergens to carry commercial kits equipped with epinephrine. Encourage this person to wear an identification tag.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. _____ is caused by a hypersensitivity to a specific substance introduced into the body for the second or a sub- sequent time.

2. If the reaction is severe due to anaphylaxis, _____ may occur.

3. Anaphylactic shock is always considered a _____.

4. Substances that can produce anaphylactic shock may be absorbed from _____ , _____ , or _____.

5. Parenteral injections of _____ are the most frequent cause of anaphylactic shock.

6. When sudden _____ results from a bee sting, this is due to anaphylactic shock.

7. Foods which can produce anaphylactic shock include _____ , _____, _____, and _____.

8. When a serum such as horse, rabbit, or bovine is being considered for injection, the person should be tested for _____.

9. List the signs and symptoms of anaphylactic shock.

   a. _____.

   b. _____.

   c. _____.

   d. _____.

10. The drug of choice for emergency treatment of anaphylactic shock is _____ _____ administered parenterally.

11. For mild generalized symptoms of anaphylactic shock, administer epinephrine _____.

12. If the reaction is more severe and is becoming steadily worse, administer epinephrine _____ or _____.

13. In the event that epinephrine does not stop and reverse the antigen-antibody reaction, it may be necessary to use one of the following:

   a. _____ to help block systemic histamine effects.

   b. _____ to combat bronchospasm and asthmatic symptoms.

   c. _____ for prolonged hypotension.

   d. _____ for reduced cardiac output.

   e. _____ to help prevent laryngeal edema.

   f. _____ for convulsions.

   g. _____ for prolonged laryngeal edema and hypotension.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. Anaphylactic. (para 3-1)

2. Anaphylactic shock. (para 3-1)

3. Serious medical emergency. (para 3-1)

4. Injections, ingestion, or inhalation. (para 3-2)

5. Penicillin. (para 3-2a(1))

6. Death. (para 3-2a(2))

7. Shellfish, fish, milk, and strawberries. (para 3-2a(3))

8. Sensitivity. (para 3-2b)

9. Respiratory signs.
   Involvement of the skin.
   Cardiac and circulatory involvement.
   Gastrointestinal effects. (para 3-3)

10. Aqueous epinephrine. (para 3-4)

11. Subcutaneously. (para 3-4a(1))

12. Intramuscularly or sublingually. (para 3-4a(2))

13. a. Diphenhydramine hydrochloride (Benadryl).

    b. Aminophylline.

    c. Plasma or colloids (dextran), vasoconstrictors.

    d. Isoproterenol or dopamine.

    e. Diphenhydramine chloride.

    f. Short-acting barbiturate or diazepam.

    g. Corticosteroids. (para 3-4b(1)-(6))

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Hepatitis
LESSON ASSIGNMENT	Paragraphs 4-1 through 4-22 and Glossary.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

4-1. Identify the major concerns about hepatitis.

4-2. Identify the differences between infectious and serum hepatitis.

4-3. Identify possible short-term and long-term effects of viral hepatitis.

4-4. Identify the signs and symptoms of viral hepatitis.

4-5. Identify the possible complications of viral hepatitis.

4-6. Identify the treatment for hepatitis.

4-7. Identify the causes and effects of toxic hepatitis.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

HEPATITIS

Section I. GENERAL

4-1. DEFINITION

Hepatitis is an inflammation of the liver. It can be caused by infectious agents that include certain viruses, bacteria, or other infectants. Hepatitis can also be caused by toxic agents to include poisons such as carbon tetrachloride and other industrial solvents, minerals (such as phosphorus), anesthetics, antibiotics, and certain drugs. Excessive indulgence in alcohol can also be toxic.

4-2. HISTORY

In 1964, Blumberg was searching for a type of genetically controlled serum antigen. He was searching because those persons who have had many transfusions can develop antibodies against these antigens. During his search, he combined the serum of a person suffering with hemophilia, who had received many transfusions, with the serum of an Australian aborigine. Material from the Australian's serum was precipitated. This material he labeled "Australian antigen." In a few years, the presence in the serum of this antigen was demonstrated to be frequently associated with a long incubation hepatitis. The antigen was then labeled "hepatitis-associated antigen" (HAA). This antigen in a person's serum is also associated with the ability of the person's blood to transmit hepatitis. For this reason, blood banks quickly set up facilities to screen all donors for the presence of this antigen in their blood. About 30 percent of the donors who are capable of transmitting hepatitis can be identified by this testing. With technical refinements in testing methods, there may be a more complete identification of infection donors. By demonstrating the existence of HAA, we have gained a greater understanding of the varieties of hepatitis. HAA appears to be mostly associated with the long incubation or serum hepatitis. Some cases of sporadic hepatitis and infectious hepatitis have HAA in their serum. This has shown that the agent for serum hepatitis can be transmitted by other than the parenteral route. It is probably spread by the fecal-oral route. The HAA has been seen in the feces and urine of some hepatitis patients. Presently viral hepatitis is separated into short incubation or infectious hepatitis and long incubation or serum hepatitis varieties.

4-3. SIGNIFICANCE

a. There are three major points about hepatitis that most concern us from a <u>military</u> point of view.

(1) How easily can hepatitis be transmitted from one person to another?

(2) What is the morbidity rate for this disease?

(3) What loss of man-hours can be expected because of hepatitis?

b. These concerns will be addressed in the balance of this lesson. Hepatitis is the most important infection that attacks the liver and has been recognized as a major health problem since World War II. Hepatitis is a reportable disease in most states, so a pool of statistics is being gathered. It is estimated that at least ten percent of all patients suffer some residual hepatic damage for as long as a year after an attack of viral hepatitis and that at least two percent have hepatic damage persisting even longer. Denmark had a large epidemic of viral hepatitis in the 1940s and this country has had an increase in deaths from chronic disease of the liver in the past fifteen years. The United States has not researched the issue long enough to determine whether or not cirrhosis or other severe degeneration of the liver occurs many years after the acute onset of the disease. Viral hepatitis seems to be most prevalent in low-income areas where there is crowding and limited sanitation. Susceptibility is highest between the ages of 6 and 25, but there is a trend toward increased incidence in adults, especially in the older age groups. Pregnant women are highly susceptible during the second and third trimesters and the mortality rate is extremely high in the last trimester. Hepatitis follows a seasonal pattern with more cases occurring in the fall and early winter. There also seems to be a cyclical pattern. Major outbreaks seem to occur about every seven years; however, the pattern is not the same in all parts of the country.

4-4. TYPES OF VIRAL HEPATITIS

Viral hepatitis comes in forms lettered from A through G. They are described in the following paragraphs.

Section II. TYPE A HEPATITIS

4-5. EPIDEMIOLOGY

a. **Distribution.** Hepatitis is about evenly distributed world-wide. It is not limited to any particular area or country.

b. **Frequency.** Infectious hepatitis is commonly seen in children and young adults of the 15 to 29 age group. It also infects persons in the middle age group who have escaped infection as children.

c. **Mode of Transmission.** The most common means of transmission is from a fecal-oral spread. This happens in a manner similar to that of typhoid fever. Person-to-person spread is usually limited to close contacts. The virus can also be spread by contaminated water and food (especially shellfish), but rarely by the respiratory route. It may also be contacted through parenteral introduction of virus through blood, blood products, or equipment. The oral-fecal route transmits the disease easily because virus is excreted in the feces long before clinical symptoms appear and it remains for long periods of time in both those who have the disease and those who are carriers.

4-6. DIFFERENTIAL DIAGNOSIS

Many acute viral infections may mimic the symptoms of infectious hepatitis. Common examples are infectious mononucleosis, leptospirosis, hepatic amebiasis, toxic hepatitis, appendicitis, and pneumonia. When the jaundice appears, there is sometimes a problem making a differential diagnosis since jaundice can have genesis in other disorders.

4-7. SYMPTOMS AND PATHOLOGY

This disease is characterized by random necrosis of liver cells. An inflammatory mononuclear collects in the liver lobule and sinusoids of involved areas. In most instances of nonfatal viral hepatitis, regeneration of the liver begins almost with the onset of the disease. The damaged cells and their contents eventually are removed by phagocytosis and enzymatic reaction and the liver return to normal. There are several factors that will influence the course and severity of the disease. The virulence of the virus is a prime factor. The stronger the virus, the stronger the disease. Prior hepatic damage is also a factor. If the patient has sustained liver damage before exposure to the virus, this will make the disease more severe. Some people seem to have natural barriers or immunity to the virus. Care following the appearance of the symptoms will also affect the course of the disease. Mostly viral hepatitis is a mild disease and complete recovery is the rule. During the course of the disease, a tender enlarged liver is apparent. Other findings can be splenomegaly, posterior cervical adenopathy and "spider" angiomas. The symptoms of the disease may not be apparent in every case. It is estimated that for every apparent case of hepatitis, there may be several cases of asymptomatic or very mild subclinical hepatitis. These cases are not usually detected. When symptoms do appear, there are usually two states or phases.

a. **Preicteric.** This stage is usually associated with headache, anorexia, nausea and vomiting, chills, fever, aches and pains, malaise, and a tender liver. There may also be fatigue and an upper respiratory flu-like infection. Those patients who smoke may develop a distaste for tobacco.

b. **Icteric.** The jaundice appears and lasts for about 2 weeks. The body temperature often returns to normal but anorexia and nausea remain. There is usually dark urine and grayish stools. The liver remains tender and perhaps enlarged. The patient experiences flatulence and may have mild pruritis.

4-8. COURSE AND PROGNOSIS

About 85 percent of the patients suffering from infectious hepatitis recover without complications in about 6 to 8 weeks. The fatality rate is 0 to 1 percent. If a complication does appear, it will be one of the following.

a. **Relapse.** About 2 to 18 percent with this disease experience a form of relapse. Sometimes, this is a milder form of the original attack. More than 1 relapse may occur, but recovery is almost always complete.

b. **Prolonged Viral Hepatitis.** In about 5 percent of the cases, the course of the disease can last up to a year. Usually there is complete recovery.

c. **Cholestatis Hepatitis.** The jaundice in this variation can last up to 30 weeks. This is also followed by complete recovery.

d. **Fulminant Hepatitis.** This is usually a fatal complication. The patient shows a rapid and steady deterioration and develops a hepatic coma and deep jaundice. The liver shows massive necrosis and shrinks in size. It is usually fatal within 10 days. This complication has also been known as "acute yellow atrophy."

4-9. TREATMENT AND NURSING CARE

Diet and activity should be adjusted to the clinical condition of the patient. The extremely ill patient will not want ambulation and may have nausea and vomiting so severe as to require supplements with 10 percent glucose solution. After gradually increasing ambulation, the patient may return to normal activity when he is asymptomatic and the liver tenderness has subsided. There is no specific medical treatment for viral hepatitis. Good general care is required. Pay attention to good oral hygiene, skin care, and elimination. Encourage fluids by mouth if nausea is not a problem. It may be necessary to entice the patient to eat. He may resist eating at first but eventually he will recover his appetite. When the appetite has returned to normal, a diet high in calories, proteins, and moderate carbohydrates is usually ordered. Fats may or may not be limited and vitamins may be given. For the patient with fulminant hepatitis, the common complications are hepatic coma, renal failure, and there is a severe bleeding tendency. Specific therapy should be directed to these complications as they arise. Prednisone has been used to promote regeneration but the therapeutic value of these agents is not certain. Exchange transfusion has apparently enabled some patients to recover. This treatment is reserved for the seriously ill patient with hepatic coma and fulminant hepatitis. It may be necessary to repeat the exchange transfusion on successive days before a response is obtained.

4-10. PROPHYLAXIS

Immune serum globulin should be administered intramuscularly within a few days of exposure. Disposable needles, syringes, and thermometers should be used for the hepatitis patient. The hepatitis virus is excreted in feces 2 to 3 weeks before and up to 1 week after the appearance of jaundice and the virus remains in the blood during the same period. Because of this, the feces and blood of patients with acute hepatitis must be considered infectious. While strict attention to personal hygiene and sanitation is necessary, rigid isolation of the patient is not necessary. Susceptible contacts are generally infected before the clinical symptoms become apparent in the transmitter. If disposable needles and syringes are not available, needles and other equipment must be boiled to destroy the virus because soaking in alcohol is useless. Proper safeguards should be used to prevent the use of blood and its components from infected or carrier donors. Food handlers should be screened carefully and sanitary practices must be used during the preparation and serving of food. Wear gloves when handling bedpans and fecal-contaminated linens. Use the patient care hand wash after possible exposure and teach the patient to wash with lots of soap and running water, especially after defecation.

Section III. TYPE B HEPATITIS

4-11. EPIDEMIOLOGY

a. **Distribution.** As with type A, the serum hepatitis (or type B) is distributed worldwide.

b. **Frequency.** Serum hepatitis is seen mostly in young adults and in older people who have been administered blood or blood products.

c. **Mode of Transmission.** This disease can be transmitted by oral-oral mode, for example from mother to child via breast-feeding. The most common means of transmission is parenterally, from the administration of blood or blood products. It may be caused by any type of injection, by renal dialysis, by drug addiction, or by intimate contact with carriers. Male homosexuals and prostitutes are very susceptible since fecal-oral spread is possible. Other susceptible persons are general surgeons, clinical laboratory workers, oral surgeons, nurses, and respiratory therapists.

4-12. SYMPTOMS AND PATHOLOGY

The pathology for serum hepatitis is the same as for infectious hepatitis. The factors which influence the course and severity of type B are also the same as for type A. The symptoms for serum hepatitis resemble those for infectious hepatitis clinically, but the onset of symptoms in more insidious. The symptoms have high variability. There is a high likelihood that some of the symptoms will not be as pronounced or will be missing. Fever and respiratory symptoms are rare and there may be no jaundice. There may be rashes and pain in the joints.

4-13. COURSE AND PROGNOSIS

This is a more severe disease than infectious hepatitis. Recovery may take many months. Case fatality rates of 10 percent have been observed in some outbreaks. Generally, the fatality rate is 1 to 10 percent.

4-14. TREATMENT AND NURSING CARE

The general treatment is similar to the treatment for infectious hepatitis. The patient should have sufficient fluids, good nutrition, and bed rest. If the patient exhibits dyspepsia and malaise, he may be administrated alkalies, belladonna, and antimetics. A newly available gamma globulin seems to reduce the severity of hepatitis type B following needle-stick or contact exposure. This can be administered following exposure by ingestion, inoculation, or splash on involved exposure surface. This gamma globulin seems to lessen the severity of the disease. Since recovery and convalescence is slow and prolonged, psychosocial stimulation should be provided.

4-15. PROPHYLAXIS

The most important preventive measure is careful attention to donor quality at blood banks. A reagent called Hepatitis Associated Antibody (anti-Australia antigen, human) is now available for screening blood for Australia antigen. The reagent will detect only about 25 percent of the units of antigen-containing blood. Drug addicts should be educated to the dangers of unsterilized syringes and needles. Physicians should avoid the use of unnecessary blood and blood products. All surgical instruments must be meticulously autoclaved before reuse. A hepatitis B vaccine is now being tested and should soon become available.

Section IV. OTHER TYPES OF HEPATITIS

4-16. VIRAL HEPATITIS C

Hepatitis C (originally “non-A/non-B hepatitis”) is caused by a flavivirus. It can be transmitted through contact with blood (including through sexual contact where the two parties’ blood is mixed). Hepatitis C may lead to a chronic form of hepatitis, culminating in cirrhosis. It can remain asymptomatic for 10 to 20 years. Patients with hepatitis C are prone to severe hepatitis if they contract either hepatitis A or B, so all hepatitis C patients should be immunized against hepatitis A and hepatitis B if they are not already immune. The virus can cause cirrhosis of the liver. HCV viral levels can be reduced to undetectable levels by a combination of interferon and the antiviral drug ribavirin. The genotype of the virus determines the rate of response to this treatment regimen. Genotype 1 is more resistant to interferon therapy than other HCV genotypes.

a. **Symptoms and Pathology.** The symptoms resemble those of serum hepatitis but are frequently less severe. There is generally no jaundice, but the liver is large and tender. In most patients, the onset is insidious. The disease waxes and wanes over many months or years. If arthritis appears as a symptom, the disease is called "lupoid hepatitis." There is probably a chronic carrier state. Incubation appears to be about 2 months.

b. **Course and Prognosis.** Hepatitis C may clear by itself after a few months or years. After several years, it may progress to cirrhosis.

c. **Treatment and Nursing Care.** Prednisone orally has been used when symptoms warranted therapy. Gamma globulin significantly reduces incidence of this type of hepatitis and reduces the incidence of chronic active liver disease.

d. **Prophylaxis.** Care must be taken to reject blood donors who have had serum hepatitis and to transfuse a patient only when this is justified. When it is available, hepatitis B vaccine should be administered. The directions for use and disposal of transfusion equipment are the same for all forms of hepatitis.

4-17. HEPATITIS D

Hepatitis D is considered a subviral satellite as it can only propagate in the presence of the hepatitis B virus.

4-18. HEPATITIS E

Hepatitis E produces symptoms similar to hepatitis A, although it can take a fulminant course in some patients, particularly pregnant women. It is more prevalent in the Indian subcontinent.

4-19. HEPATITIS F

Hepatitis F is a hypothetical virus linked to hepatitis. Several hepatitis F candidates emerged in the 1990s; however, none of these reports have been substantiated.

4-20. HEPATITIS G

Another type of hepatitis, hepatitis G, has been identified and is probably spread by blood and sexual contact. There is, however, doubt about whether it causes hepatitis or is just associated with hepatitis since it does not appear to be primarily replicated in the liver.

4-21. TOXIC HEPATITIS

Toxic hepatitis is hepatitis caused by the direct action of poison on the liver cells. These chemicals may be taken into the system by inhalation, ingestion, skin absorption, or injection. The chemicals can cause liver poisoning, a hepatitis-like reaction, an allergic reaction that inhibits the flow of bile (hypersensitivity cholestasis), or bile flow inhibited by steroids (steroid cholestasis).

a. **Causes.** A direct toxic effect may be caused by carbon tetrachloride, insecticides, industrial solvents, various metallic compounds (such as arsenic, gold, mercury, and iron), hydrazine drugs (such as isoniazid), and halothane anesthetics. The latter two may produce a condition indistinguishable from that of acute viral hepatitis.

b. **Effects.** These poisons may produce any or all of these effects: nausea, vomiting, jaundice, stupor, or coma.

c. **Treatment.** The primary treatment is to remove the patient from further exposure to the offending substance, if it is known. Further treatment varies with the causative agent. General treatment is bed rest and supportive care.

d. **Prognosis.** The extent of damage is related to the dose of the substance. Some patients recover with little residual hepatic damage and some have severe permanent damage.

e. **Hypersensitivity cholestasis.** Phenothiazines (especially chlorpromazine), chlorpropamide, pheylbutazome, and sulfonamides may cause cholestatic jaundice and "allergic" damage to biliary canaliculi and liver cells. Recovery is usual, but prolonged jaundice and even death have been reported.

f. **Steroid Cholestasis.** If given in sufficient quantities, methyltestosterone, norethandrolone, methandrostenolone, norethindrone, and other C-17 alkyl-substituted steroids will eventually cause a mild reversible cholestasis with minimal changes in the biliary canaliculi. Jaundice may be marked, but recovery is the rule.

4-22. ALCOHOLIC (ETHANOL) HEPATITIS

This form of hepatitis is seen exclusively in alcoholics and characterized by the symptoms and signs of severe disruption of hepatic functions. It is a form of toxic hepatitis.

a. **Causes.** The pathogenesis is not established. Some of the patients are obese. Males and females are affected about equally.

b. **Pathology.** The liver becomes large, firm, and often tender. There are fatty changes, scattered areas of necrosis, an inflammatory reaction, disorganization of the liver functions and stoppage of bile in the narrow passageways. In many sections, fine strands of connective tissue extend into the lobules. Other sections may show clear-cut signs of cirrhosis as well.

c. **Signs and Symptoms.** This illness appears suddenly with fever, jaundice, ascites, and edema. In a short time, vascular "spiders" may appear. There may be a bleeding phenomena. There is often an increased white blood count (WBC) and usually anemia. Laboratory tests show severe disruption of liver functions.

d. **Treatment.** Treatment will include bed rest, abstaining from consumption of alcohol, providing the required diet, and supportive measures as for cirrhosis. A multivitamin preparation is usually given and should include folic acid.

e. **Prognosis.** A considerable number of patients die after a brief illness. Some patients recover completely and others will progress to develop cirrhosis.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. What is hepatitis?

   _____

2. What causes hepatitis?

   _____

3. The agent for serum hepatitis can be transmitted by other than parenteral route. It is probably spread by the _____.

4. List the three major points about hepatitis that concerns the military point of view.

   a. _____.

   b. _____.

   c. _____.

5. _____ hepatitis seems to be most prevalent in low-income areas that are crowded and have limited sanitation.

6. Hepatitis follows a seasonal pattern with more cases occurring _____ and _____.

7. Serum hepatitis is known as _____ while infectious hepatitis is known as _____.

8. Another type of hepatitis is _____ , which was originally called _____ because it is caused by a virus that is neither A nor B.

9. Hepatitis is characterized by random necrosis of _____.

10. Several factors that influence the course and severity of infectious hepatitis are:

_____

_____

11. What are the two stages of infectious hepatitis?

_____

_____

12. What are the symptoms of the preicteric and icteric stages?

_____

_____

_____

_____

13. What are the complications that may arise from infectious hepatitis?

_____

_____

_____

14. Although there is no specific medical treatment for infectious hepatitis, the following steps are necessary for good general care:

_____

_____

_____

_____

15. The feces and blood of patients with acute hepatitis must be considered to be

_____ .

16. If disposable needles and syringes are not available for use with the hepatitis patient, needles and other equipment must be _____ to destroy the virus because soaking in alcohol is useless.

17. _____ is seen mostly in young adults and in older people who have been administered blood or blood products.

18. Serum hepatitis may be transmitted by _____

_____

19. Persons susceptible to serum hepatitis include _____,

_____ , _____ , _____ ,

_____ ,_____ , and _____,

20. The general treatment for Type B hepatitis is _____ ,

_____, and _____.

21. The most important preventive measure is careful attention to_____ at blood banks.

22. Other measures to prevent serum hepatitis include:

_____

_____

_____

_____

23. The _____ type of hepatitis is only propagated with type B hepatitis and cannot create an effect on it's own.

24. _____ is hepatitis caused by the direct action of poison on the liver cells.

25. Toxic hepatitis may be caused by: _____.

_____

_____

26. The primary treatment for toxic hepatitis is _____.

27. _____ hepatitis is seen exclusively in alcoholics and characterized by the symptoms and signs of severe disruption of hepatic functions.

28. What are the signs and symptoms of alcoholic (ethanol) hepatitis?

_____

_____

_____

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. Hepatitis is an inflammation of the liver. (para 4-1)

2. Hepatitis can be caused by infectious agents that include certain viruses, bacteria, other infectants, toxic agents, and an excessive use of alcohol. (para 4-1)

3. Fecal-oral route. (para 4-2)

4. How easily can hepatitis be transmitted from one person to another?
   What is the morbidity rate for this disease?
   What loss of man-hours can be expected because of hepatitis? (para 4-3)

5. Viral. (para 4-3a)

6. In the fall and early winter. (para 4-3b)

7. Type B; Type A. (paras 4-11a, 4-5c)

8. Hepatitis C; non-A/non-B. (para 4-16)

9. Liver cells. (para 4-7)

10. The virulence of the virus.
    If the patient had sustained liver damage before exposure to the virus. (para 4-7)

11. Preicteric and icteric. (para 4-7a, b)

12. Preicteric: Characterized by headache, anorexia, nausea and vomiting, chills, fever, aches and pains, malaise, and tender liver.
    Icteric: Jaundice appears and stays approximately 2 weeks; temperature returns to normal, but anorexia and nausea remain; dark urine and grayish stools, liver remains tender and may be enlarged. (para 4-7a, b)

13. Relapse, prolonged viral hepatitis, cholestasis hepatitis, or fulminant hepatitis. (para 4-8)

14. Pay attention to good oral hygiene, skin care, and elimination.
    Encourage fluids by mouth if nausea is not a problem.
    Entice the patient to eat.
    When the appetite has returned to normal, provide a diet high in calories, proteins, and moderate carbohydrates. (para 4-9)

15. Infectious. (para 4-10)

16. Boiled. (para 4-10)

17. Serum hepatitis. (para 4-11b)

18. Any type of injection, by renal dialysis, by drug addiction, or by intimate contact with carriers. (para 4-11c)

19. Male homosexuals, prostitutes, general surgeons, clinical laboratory workers, oral surgeons, nurses, and respiratory therapists. (para 4-11c)

20. Sufficient fluids, good nutrition, and bed rest. (para 4-14)

21. Donor quality. (para 4-15)

22. Educate drug addicts to the dangers of unsterilized syringes and needles. Avoiding the use of unnecessary blood and blood products by physicians. Autoclaving all surgical instruments meticulously before reuse. Administering the hepatitis B vaccine that is now being tested. (para 4-15)

23. Type D. (para 4-17)

24. Toxic hepatitis. (para 4-21)

25. Carbon tetrachloride, insecticides, industrial solvents, metallic compounds hydrazine drugs, halothane anesthetics. (para 4-21a)

26. To remove the patient from further exposure to the offending substance. (para 4-21c)

27. Alcoholic (ethanol). (para 4-22)

28. A sudden appearance of fever, jaundice, ascites, and edema, vascular "spiders", bleeding phenomena, increased white blood count and severe disruption of liver functions. (para 4-22c)

End of Lesson 4

APPENDIX A

SNAKE VENOM POISONING AND ANTIVENINS

Date: _____

Time: _____

LAC-USC GUIDE FOR SNAKE VENOM POISONING

Tissue destruction, hemostatic defects, hemorrhage, cardiovascular and neurological changes, and respiratory distress may result from snake venom poisoning. Immediate or delayed serum reactions and infection may complicate the poisoning. The severity of the injury should be assessed by the degree and rapidity of the onset of symptoms and signs and data from laboratory tests. Continual reevaluation of the poisoning must be made as the response to treatment progresses. Remember, snake venom poisoning is a medical emergency requiring immediate attention, that it is a multiple-type poisoning and, finally, that the fact that the patient has been bitten by a venomous snake does not necessarily mean that he has been envenomated. Twenty percent of all rattlesnake bites seen at this Medical Center show no evidence of poisoning. In cases of a bite by any snake, NOTIFY THE LABORATORY OF NEUROLOGICAL RESEARCH — 4741, 4742, 4743. PLEASE COMPLETE THIS FORM AS COMPLETELY AS POSSIBLE.

ADMITTING DATA: 1. Patient age: _____ 2. Sex: _____ 3. Date/time of bite _____

4. Location (city, county etc.) _____
5. Description of snake _____
6. Species (if known): _____ 7. Identified by: _____
8. Immediate (< 30 min) reactions to bite (circle & comment):
   - a. Swelling 0 1 2 3 4 _____
   - b. Local pain 0 1 2 3 4 _____
   - c. Paresthesias 0 1 2 3 4 _____
   - d. Fasciculations 0 1 2 3 4 _____
   - e. Ecchymoses 0 1 2 3 4 _____
   - f. Nausea 0 1 2 3 4 _____
   - g. Weak-paralysis 0 1 2 3 4 _____
   - h. Resp. distress 0 1 2 3 4 _____
   - i. Other (describe) _____

9. First aid: yes no Time: _____ Methods: _____
10. Treatment at other facilities: yes no Time: _____ Describe (include antivenin, dose, route)

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INITIAL LAC-USC FINDINGS Date/time of admission: _____ RR _____ BP
11. Symptoms: _____ Temp _____ HR
12. Describe wound and bitten part: _____

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13. Local sensory-motor exam (pain, pin, range of motion, joint, strength): _____
14. Edema: 0 1 2 3 4 15. Ecchymoses: 0 1 2 3 4 16. Petechiae: 0 1 2 3 4 17. Bullae: 0 1 2 3 4
18. Systemic findings (hemodynamic, hematologic, neuromuscular): _____
19. Initial lab studies: _____

FOR ADULTS AND CHILDREN > 35 KG PLEASE OBTAIN 1 RED TOP AND 1 LAVENDER (CBC) TUBE OF BLOOD ON ADMISSION AND Q8H FOR THE INITIAL 48H. LABEL TIME-DATE AND PATIENT NAME. PLACE IN REFRIGERATION ON CD ADMITTING WARD.

20. INITIAL SEVERITY ASSESSMENT (circle) NO ENVENOMATION MINIMAL MODERATE SEVERE
21. Comments: _____

GUIDELINES FOR MANAGEMENT

By the time the patient arrives at the Medical Center it will be too late for any effective first aid measures. Do nothing but cleanse the wound area at this time.

ANTIVENIN: See brochure in package. If plan to use be sure to skin test. Do not give if lacking evidence of envenomation, give as early as possible, and IV in appropriate vehicle. GIVE ENOUGH. There is a tendency to give too little. Minimal envenomation will require 3–5 vials, moderate, 6–10 and severe, 10–40. Again, DO NOT GIVE WITHOUT SKIN TESTING. Inject all antivenin intravenously. Watch for any reactions, even when skin test has been negative. If skin test is positive and patient requires antivenin, get consultation STAT (4741).

SENSITIVITY TEST: When _____ Where _____
Results _____

ANTIVENIN: Amount _____ When started _____ Dilution ____
When stopped _____ Reactions _____ Additional antivenin, amount _____ When _____.

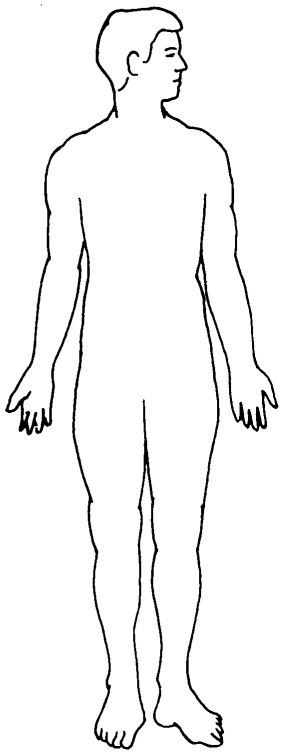
OTHER IMMEDIATE CARE (circle): Immobilization, tetanus, pain medications, Other medications, IV fluids, Oxygen, Burows soaks, debridement, triple dye, antibiotics, p.t., other _____

LABORATORY TESTS: See instructions on board, C.D.2

FOLLOW-UP CARE:

The symptoms and signs of rattlesnake venom poisoning may be relatively minor during the first hour following the bite, in spite of serious envenomation. If swelling progresses rapidly, parasthesias worsen or either fail to respond to initial antivenin administration, anticipate a severe poisoning. Shock may develop in some cases and warrant immediate shock measures. Avoid corticosteroids. Do not perform a fasciotomy. Do not pack in ice. Do not elevate extremity during first 48 hours. If you require consultation, do not hesitate to call 4741. Further instructions and references are on C.D.2 bulletin board. See also J.A.M.A 233(4), 341, 1975.

COMMENTS: _____



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Antivenins

A listing of available antivenins for the treatment of envenomations by exotic snakes is given below in Table 8-2. This listing is updated from that authored by Russell and Lauritzen,[45] to which the reader is directed for a more detailed discussion of antivenins. *(Text continued on p. 395)*

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
North America					
Wyeth Laboratories Box 8299, Philadelphia, Pennsylvania, U.S.A.	*Crotalus durissus terrificus*, *Bothrops atrox*, *Crotalus adamanteus*, *Crotalus atrox*	Antivenin (Crotalidae) Polyvalent	South American rattlesnake, Barba Amarilla, Eastern diamondback rattlesnake, Western diamondback rattlesnake	*Crotalus* sp., *Sistrurus* sp., *Agkistrodon* sp. (Old & New World), *Bothrops* sp., *Lachesis* sp., *Trimeresurus* sp.	Precipitated with ammonium sulphate, and lyophilized
	Micrurus fulvius fulvius	Antivenin (*Micrurus fulvius*)	Eastern coral snake	*Micrurus fulvius tenere*	
Laboratorios "MYN", S.A. Av. Coyoacan 1707 Mexico City 12, D.F., Mexico	*Bothrops atrox asper*	Monovalent Bothrops	Terciopelo		Enzyme digested, precipitated with ammonium sulphate, and lyophilized
	Crotalus atrox, *Crotalus d. terrificus*, *Crotalus tigris*	Polyvalent Crotalus	Western diamondback rattlesnake, South American rattlesnake, Tiger rattlesnake	All Mexican crotalids	
	Bothrops atrox asper, *Crotalus d. terrificus*, *Crotalus tigris*, *Crotalus atrox*	Polyvalent Mexico	Terciopelo, South American rattlesnake, Tiger rattlesnake, Western diamondback rattlesnake	All Mexican crotalids	

(continues)

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
North America					
Instituto Nacional de Higiene, Csda. M. Escobedo No. 20, Mexico City, D.F., Mexico	*Bothrops atrox asper*	Anti-Bothrops	Terciopelo		Ammonium sulphate precipitation. Supplied in liquid form.
	Crotalus b. basiliscus *Crotalus d. terrificus*	Anti-Crotalus	Mexican rattlesnake South American rattlesnake		
	Bothrops atrox asper *Crotalus b. basiliscus* *Crotalus d. terrificus*	Polyvalent	Terciopelo Mexican rattlesnake South American rattlesnake		
Central and South America					
University de Costa Rica Ciudad Universitaria Rodrigo Facio San Jose, Costa Rica	*Lachesis muta stenophyrs*	Anti-Laquesico	Bushmaster	*Lachesis muta muta* *Lachesis muta noctiyaga*	Precipitated with ammonia sulphate Freeze dried or liquid
	Bothrops atrox asper *Crotalus durissus durissus* *Lachesis muta stenophyrs*	Polyvalent	Terciopelo Central American Rattlesnake Bushmaster	*Lachesis muta muta* *Lachesis muta noctiyaga* *Agkistrodon bilineatus* *Bothrops nummifer* *Bothrops picadoi* *Bothrops nasutus* *Bothrops ophryomegas* *Bothrops godmanni* *Bothrops lateralis* *Bothrops schlegelii* *Bothrops nigroviridis*	

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized	Comments
Central and South America					
	Micrurus nigrocinctus nigrocinctus *Micrurus nigrocinctus mosquitensis*	Anti-Coral (Central America)		*Micrurus carinicaudus* *dumerilii* *Micrurus fulvius* *fulvius*	
	Micrurus nigrocinctus *Micrurus mipartitus* *Micrurus frontalis*	Anti-Coral Polyvalent		*Micrurus fulvius* *fulvius* *Micrurus alleni* *Micrurus carinicaudus* *Micrurus spixii* *Micrurus lemniscatus* *Micrurus corallinus*	
Instituto Nacional de Salud Ave. Eldorado con Carrera, Zona G, Bogota, D.E., Colombia	*Bothrops atrox* *Crotalus d. terrificus*	Antiophidico Polivalente	Barba Amarilla South American rattlesnake	*Bothrops* species *Crotalus* species	Globulin precipitated with ammonium sulphate
Laboratorio Behrens Ave. Principal de Chapellin, Apartado 62, Caracas, 101 Venezuela	*Crotalus d. terrificus*		South American rattlesnake or cascabel	*Crotalus vegrandis*	Foreign-protein-reduced
	Bothrops atrox *Bothrops venezuelae*		Barba Amarilla Tigra-mariposa	*Bothrops colombiensis*	

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Central and South America					
	Bothrops atrox *Bothrops venezuelae* *Crotalus d. terrificus*		Barba Amarilla Tigra-mariposa South American rattlesnake or cascabel	*Bothrops colombiensis* *Bothrops bilineata* *Bothrops lansbergii* *Bothrops lichenosus* *Bothrops medusa* *Bothrops neglectus* *Bothrops schlegelii* *Crotalus vegrandis*	
Instituto Nacional de Microbiologia Avdo. Velez Sarsfield 563. Buenos Aires, Argentina	*Crotalus d. terrificus*		South American rattlesnake or cascabel	Purified by enzymatic and differential thermocoagulation techniques (No recent confirmation)	
	Bothrops alternatus *Bothrops neuwiedii*	Bothrops Bi-Valent	Yarara or de la Cruz Wied's lance-head, Yarara Chica or painted jararaca		
	Bothrops alternatus *Bothrops jararaca* *Bothrops jararacussu* *Bothrops neuwiedii* *Crotalus d. terrificus*	Tropical Polyvalent	Yarara or de la Cruz Jararaca Yarara Wied's lance-head South American rattlesnake or cascabel		

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized	Comments
Central and South America					
	Bothrops alternatus *Bothrops neuwiedii* *Crotalus d. terrificus*	Tropical Tri-Valent	Yarara or de la Cruz Wied's lance-head South American rattlesnake		
Instituto Butantan Ciaxa Postal 65, São Paulo, Brazil	*Crotalus d. terrificus*	Anticrotalic	South American rattlesnake or *cascabel*	It can be expected that the antivenins of this institute neutralize other crotalid venoms, even though the producers note in a personal letter that the scarcity of data preclude any specific claims.	Pepsin-digested, and ammonium sulfate precipitation
	Lachesis muta	Antilaquetico	Bushmaster or Surucucu		
	Bothrops jararaca *Bothrops moojeni* *Bothrops cotiara* *Bothrops alternatus* *Bothrops jararacussu* *Bothrops neuwiedi*	Antibothropico	Jararaca Moojen's pit viper Cotiara Urutu Jararacussu Wied's lance-head or painted jararaca		
	Crotalus d. terrificus		South American rattlesnake		
	Bothrops jararaca *Bothrops moojeni* *Bothrops cotiara* *Bothrops alternatus* *Bothrops jararacussu* *Bothrops neuwiedi*	Antiophidico Polyvalent	Jararaca Moojen's pit viper Cotiara Urutu Jararacussu Wied's lance-head or painted jararaca		

(continues)

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Central and South America					
	Lachesis muta	Antibothropico-lachetico	Bushmaster		
	Bothrops alternatus		Urutu		
	Bothrops jararacussu		Jararacussu		
	Bothrops jararaca		Jararaca		
	Bothrops moojeni		Moojen's pit viper		
	Bothrops cotiara		Cotiara		
	Bothrops neuwiedi		Wied's lance-head or painted jararaca		
	Micrurus frontalis	Antielapidico			
	Micrurus corallinus				
Syntex do Brasil S/A-Industria e Comercio Ciaxa Postal 951, São Paulo, Brasil	*Crotalus d. terrificus*		South American rattlesnake or cascabel		Pepsin digestion, and ammonium sulphate precipitation. Final solution contains 18% protein.
	Bothrops alternatus		Uruta		
	Bothrops atrox		Barba Amarilla		
	Bothrops jararaca		Jararaca		
	Bothrops jararacussu		Jararacussu		
	Bothrops cotiara		Cotiara		
Europe					
Institut Pasteur Annexe de Garches 92 (Hauts-de-Seine), Paris, France	*Vipera aspis*	Ipser V	Jura viper		Concentrated and purified to 12 to 13% protein
	Vipera berus		European viper		
	Vipera ammodytes	Ipser Europe	Long-nosed viper		
	Vipera aspis		Jura viper		
	Vipera berus		European viper		

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized	Comments
Europe					
	Bitis arietans	Bitis-Echis-Naja	Puff adder		
	Bitis gabonica		Gaboon viper		
	*Bitis nasicornis***		Rhinoceros viper		
	Echis carinatus		Saw-scaled viper		
	*Hemachatus haemachatus***		Ringhals		
	Naja haje		Egyptian cobra		
	Naja melanoleuca		Forest cobra		
	Naja nigricollis		Spitting cobra		
	*Naja nivea***		Cape cobra		
	Vipera ammodytes	Near and Middle East	Long-nosed viper		
	Vipera lebetina obtusa		Levantine viper		
	Vipera palestinae		Palestine viper		
	Cerastes cornutus		Horned viper		
	Cerastes vipera		Avicenna's viper		
	Echis carinatus		Saw-scaled viper		
	Naja naja		Indian cobra		
	Naja haje		Egyptian cobra		
	Naja naja kaouthia	Cobra	Yellow cobra		
	*Dendroaspis angusticeps***	Dendroaspis	Eastern green mamba		
	Dendroaspis jamesoni		Jameson's mamba		
	*Dendroaspis polylepis***		Black mamba		
	Dendroaspis viridis		Western green mamba		

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Europe					
Behring Institut Behringwerke AG D3550 Marburg/ Lahn Germany	*Vipera ammodytes* *Vipera berus*	*Europe*	*Long-nosed viper* *European viper*	*Vipera aspis* *Viper lebetina* *Vipera xanthina*	Prepared by pepsin digestion, and ammonium sulphate precipitation. Final solution contains 16% protein. Supplied in liquid form.
	Bitis lachesis	*North and West Africa*	*Puff adder*	*Cerastes cerastes*	
	Bitis gabonica		*Gaboon viper*	*Cerastes vipera*	
	Echis carinatus		*Saw-scaled viper*	*Naja melanoleuca*	
	Naja haje		*Egyptian cobra*	*Naja nigricollis*	
	Vipera lebetina		*Levantine viper*		
	Bitis lachesis	*Central Africa*	*Puff adder*	*Bitis nasicornis*	
	Bitis gabonica		*Gaboon viper*	*Dendroaspis viridis*	
	Dendroaspis polylepis		*Black mamba*	*Hemachatus haemachatus*	
	Naja haje		*Egyptian cobra*	*Naja melanoleuca* *Naja nigricollis*	
	Echis carinatus	*Near and Middle East*	Saw-scaled viper	*Cerastes cerastes*	
	Naja haje		Egyptian cobra	*Vipera xanthina*	
	Vipera ammodytes		Long-nosed viper	*Cerastes cornutus*	
	Vipera lebetina		Levantine viper		
Istituto Sieroterapico e Vaccinogeno Toscano "Sclavo," Via Fiorentine 1, Siena, Italy	*Vipera ammodytes* *Vipera aspis* *Vipera berus* *Vipera ursinii*	Antiviperin	Long-nosed viper Jura viper European viper Orsini's viper	All European vipers	Enzyme-refined and supplied in liquid form

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Europe					
Institute of Immunology Rockefellerova 2 Zagreb, Yugoslavia	*Vipera ammodytes*	Antiviperinum	Long-nosed viper	*Vipera berus* *Vipera aspis*	Solution digested with pepsin, and precipitated with ammonium sulphate
Institute of Epidemiology and Microbiology Sofia, Bulgaria	*Vipera ammodytes*		Long-nosed viper	*Vipera berus* *Vipera aspis*	Ammonium sulphate precipitation
Research Institute of Vaccine and Serum Ministry of Public Health Ul. Kafanova 93 Tashkent, U.S.S.R.	*Echis carinatus*	Monovalent Echis carinatus	Saw-scaled viper		No confirmation or recent letter indicating product or processing.
	Naja naja	Monovalent Naja naja	Indian cobra		
	Vipera lebetina	Monovalent Vipera lebetina	Levantine viper		
	Echis carinatus *Naja naja*	Polyvalent Naja and Echis	Saw-scaled viper Indian cobra		
	Naja naja *Vipera lebetina*	Polyvalent Vipera and Naja	Indian cobra Levantine viper		
Africa					
Institut Pasteur d'Algerie, Rue Docteur Laveran, Alger, Algeria	*Cerastes cerastes* *Vipera lebetina*	Antiviperin	Horned viper Levantine viper		Solution digested with pepsin and precipitated with ammonium sulphate

Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Africa					
The South African Institute for Medical Research P.O. Box 1038 Johannesburg 2000, Republic of South Africa	*Hemachatus haemachatus* *Naja nivea* *Naja haje* *Naja melanoleuca* *Naja nigricollis* *Dendroaspis angusticeps* *Dendroaspis jamesoni* *Dendroaspis polylepis* *Bitis arietans* *Bitis gabonica*	Polyvalent	Ringhals Cape cobra Egyptian cobra Forest cobra Spitting cobra Eastern green mamba Jameson's mamba Black mamba Puff adder Gaboon viper	*Naja naja* *Ophiophagus hannah* *Pseudohaje goldii* *Walterinnesia egyptia* *Dendroaspis viridis*	Digested wit pepsin and precipitatec with ammoniun sulphate
	Echis carinatus	Echis	Saw-scaled viper	*Echis coloratus*	
	Dispholidus typus	Boomslang	Boomslang	*Cerastes cerastes* *Cerastes vipera*	
FitzSimmon's Snake Park, P.O. Box 1 Snell Parade, Durban, Republic of South Africa	*Dendroaspis angusticeps* *Dendroaspis jamesoni* *Dendroaspis polylepis*		Eastern green mamba Jameson's mamba Black mamba	*Dendroaspis viridis*	Digested wit pepsin, precipitatec with ammoniun sulphate, a dialyzed
	Hemachatus haemachatus *Naja nivea* *Bitis arietans* *Bitis gabonica*		Ringhals Yellow cobra Puff adder Gaboon viper	*Naja naja* and African cobras	
Asia					
Central Research Institute Kasauli (Simla	*Bungarus caeruleus* *Naja naja* *Vipera russelli*	Polyvalent	Indian krait Indian cobra Russell's viper	*Bungarus fasciatus* *Naja hannah*	Enzyme-refined, equine globulin

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Asia					
Haffkine Bio-Pharmaceutical Corporation Ltd. Parel, Bombay, India	*Bungarus caeruleus*	Bungarus	Indian krait		Digested with pepsin, concentrated and lyophilized
	Naja naja	Naja	Indian cobra		
	Vipera russelli	Vipera	Russell's viper		
	Echis carinatus	Echis	Saw-scaled viper		
	Bungarus caeruleus	Polyvalent	Indian krait		
	Naja naja		Indian cobra		
	Echis carinatus		Saw-scaled viper		
Perusahaan Negara Bio Farma 9 Jalan Pasteur, Bandung, Indonesia	*Agkistrodon rhodostoma*		Malayan pit viper		Purified serum supplied in liquid form
	Bungarus fasciatus		Banded krait		
	Naja naja sputatrix		Malayan cobra		
Institut d'Etat des Serum et Vaccins Razi P.O. Box 656, Teheran, Iran	*Naja naja oxiana*		Oxus cobra		Prepared by pepsin digestion, and ammonium sulphate precipitation
	Vipera lebetina		Levantine viper		
	Echis carinatus		Saw-scaled viper		
	Pseudocerastes persicus		Persian horned viper		
	Vipera latasti		Snub-nosed viper		
	Agkistrodon halys		Mamushi		

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Asia					
	Naja naja oxiana	Polyvalent	Oxus cobra	*Cerastes cerastes*	
	Vipera lebetina		Levantine viper	*Eristicophis macmahonii*	
	Vipera xanthina		Near East viper	*Vipera aspis*	
	Echis carinatus		Saw-scaled viper	*Vipera cerastes*	
	Pseudocerastes persicus		Persian horned viper	*Vipera latasti*	
	Agkistrodon halys		Mamushi	*Vipera x. palaestinae*	
Rogoff Medical Research Institute	*Echis coloratus*	Arabian Echis	Arabian saw-scaled viper		Whole venom plus resin-bound "neurotoxin" used as antigen Supplied as globulin fraction of horse serum in liquid form
Beilinson Medical Center, Tel-Aviv, Israel	*Vipera xanthina palaestinae*	Palestine viper	Palestine viper		
Laboratory of Chemo-therapy and Serum Therapy 1 Furukyo-machi Kumamoto City, Kyushu, Japan	*Trimeresurus flavoviridis*	Habu	Habu		Pepsin digestion, ammonium sulphate precipitation, and lyophilized
	Agkistrodon halys	Mamushi	Mamushi		
The Takeda Chemical Industries, Ltd. Higashi-Ku Osaka, Japan	*Trimeresurus flavoviridis*	Habu	Habu		Pepsin digestion, ammonium sulphate precipitation, and lyophilized
	Agkistrodon halys	Mamushi	Mamushi		

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized	Comments
Asia					
Serum and Vaccine Laboratories Alabang, Mutinlupa, Rizal, Philippines	*Naja naja philippinensis*	Cobra	Philippine cobra		Concentrated and purified
National Institute of Preventive Medicine 161 Kun-Yang St., Nan-Kang, Taipei, Taiwan	*Agkistrodon acutus*	Agkistrodon	Long-nosed pit viper	*Trimeresurus mucro-squamatus*	Immunized with formalin—toxoid venom. Venom ammonium sulphate precipitated, and supplied in liquid or lyophilized form
	Bungarus multicinctus	Bungarus	Many-banded krait		
	Naja naja atra	Naja	Chinese cobra		
	Trimeresurus stejnegeri	Trimeresurus	Bamboo viper	*Agkistrodon acutus*	
	Trimeresurus mucro-squamatus		Chinese habu		
	Bungarus multicinctus	Naja-Bungarus	Many-banded krait		
	Naja naja atra		Chinese cobra		
Queen Saovabha Memorial Institute Rama 4 Road, Bangkok, Thailand	*Bungarus fasciatus*	Bungarus	Banded krait		Lyophilized whole serum
	Naja naja	Cobra	Indian cobra		
	Ophiophagus hannah	King cobra	King cobra		
	Vipera russelli	Russell's viper	Russell's viper		
	Agkistrodon rhodostoma	Malayan pit viper	Malayan pit viper		
	Trimeresuras albalabris and *T. erythrurus*	Bivalent	White-lipped tree viper		

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Australia					
Commonwealth Serum Laboratories†† 45 Poplar Road, Parkville, Victoria 3052, Australia	*Acanthophis antarcticus*	Death adder	Common death adder	*Acanthophis pyrrhus*	Prepared by pepsin digestion, and ammonium sulphate precipitation. The products are dialyzed and ultrafiltered to a final concentration of 17% protein.
	Notechis scutatus *Enhydrina schistosa*	Tiger-sea snake	Mainland tiger snake Beaked sea snake	*Austrelaps superba* *Pseudechis porphyriacus* *Tropidechis carinatus* Laboratory experiments indicated that antivenin neutralizes at least 12 different sea snake antivenins.	
	Oxyuranus scutellatus	Taipan	Taipan		
	Pseudonaja textilis, or	Eastern brown snake	Eastern brown snake	*Pseudonaja affinis* *Pseudonaja nuchalis*	
	Pseudechis australis	Brown snake	King brown snake	*Pseudechis australis* *Pseudechis porphyriacus*	
	Oxyuranus scutellatus *Acanthophis antarcticus* *Notechis scutatus* *Pseudechis australis* *Pseudonaja textilis*	Polyvalent (Australia–New Guinea)	Taipan Death adder Tiger snake King brown snake Eastern brown snake	*Austrelaps superba* *Pseudechis porphyriacus* *Pseudonaja affinis* *Pseudonaja nuchalis* *Pseudechis papuanus* *Parademansia microlepidota*	

Since the preparation of this table in March, 1979, the following data have been received, and supplement Table 8-2. I am indebted to doctors A. Ohsaka, Y. Sawai, F. Kornalik, and A. H. Mohamed for additional data. A revision of this table will be made by the W.H.O., Biologicals.

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	*Venoms Used in Preparation*	*Trade or Common Name*	*Common Name of Snake*	*Additional Venoms Neutralized**	*Comments*
Central and South America					
Instituto Nacional de Higiene Guayaquil Ecuador	*Bothrons atrox*	Anti-Bothrops	Barba Amarilla		Precipitated with ammonium sulphate and supplied in liquid form.
Instituto Nacional de Higiene Lima, Peru	*Bothrops atrox* *Bothrops brazili* *Lachesis muta*	Bothropico Polyvalent Anti-Laquesico	Barba Amarilla Bushmaster		Purified and lyophilized
Europe					
Institute for Sera and Vaccines W. Pieck Street Prague 2 C.S.S.R.	*Vipera ammodytes* *Vipera berus*	Venise	Long-nosed viper European viper	All European vipers	Pepsin digested and precipitated with ammonium sulphate. Supplied in liquid form.
Asia					
Industrial and Pharmaceutical Corporation Rangoon Burma	*Naja n. kaouthia* *Vipera r. siamensis*	Divalent	Siamese cobra Russell's viper		Precipitated with ammonium sulphate and lyophilized.
Serum Laboratory Shanghai Peoples Republic of China	*Agkistrodon halys* *Agkistrodon acutus*	Mamushi 100-Pace snake	Mamushi 100-Pace snake		Precipitated with ammonium sulphate and lyophilized.

Table 8-2. Antivenins Available for the Treatment of Poisoning by Exotic Snakes (continued)

Producer or Distributor	Venoms Used in Preparation	Trade or Common Name	Common Name of Snake	Additional Venoms Neutralized*	Comments
Asia					
Research Institute for Microbial Diseases Ohsaka University Kita-ku Osaka Japan	*Trimeresurus flavoviridis* *Agkistrodon halys*	Habu Mamushi	Habu Mamushi		Pepsin digestion, and ammonium sulphate precipitation. Lyophilized.
Kitasato Institute Minato-ku Tokyo Japan	*Trimeresurus flavoviridis* *Agkistrodon halys*	Habu Mamushi	Habu Mamushi		Pepsin digestion and ammonium sulphate precipitation. Lyophilized.
Chiba Prefectural Serum Institute Ichikawa Chiba Prefecture Japan	*Trimeresurus flavoviridis* *Agkistrodon halys*	Habu Mamushi	Habu Mamushi		Pepsin digestion, and ammonium sulphate precipitation. Lyophilized.

Additional antivenins are prepared in Egypt (Al Agousa-Sharea Alvezara, Cairo): a polyvalent *Cerastes* serum and a polyvalent serum using *Naja haja*, *Cerastes cerastes*, and *Vipera cerastes* venoms. Specific data not available at time of writing.

*Additional venoms which said antivenin may neutralize, according to the producer. It can be expected that the antivenin will afford some protection, even though it might be slight, against the venoms of snakes of closely related species.
**Paraspecific.
†Data on antivenins from Japan supplied by Dr. A. Ohsaka, National Institute of Health, Tokyo, Japan.
††Manufacturer states that no true monospecific commercial antivenins are available. Horses are first "sensitized" to all major venoms and may then be used to produce a succession of separate antivenins.

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End of Appendix A

APPENDIX B

GLOSSARY

A

Adenopathy--Enlargement of the glands, especially of the lymphatic glands.

Amebiasis--The state of being infected with an ameba.

Angiogram--A type of X-ray of blood vessels filled with a contrasting medium, done for diagnostic purposes.

Angiomas--Tumors made up of blood vessels or lymph vessels.

Antibody--A molecule which interacts only with the antigen that induced its synthesis or an antigen closely related to it.

Antiemetic--An agent preventing or alleviating nausea and vomiting.

Antigen--Any substance which is capable of inducing a specific immune response, like an antibody.

Arroyos--A creek or stream in an arid region.

Ascites--Accumulation of serous fluid in the abdominal cavity.

Asymptomatic--Showing or causing no symptoms.

Atrophy--A wasting away as in the size of a cell, tissue, organ, or part.

B

Bradycardia--A slowing of the heartbeat.

C

Canaliculi--An extremely narrow tubular passage or channel.

Cervical--Pertaining to the neck or to the neck of any organ or structure.

Cholestasis--Stoppage or suppression of the flow of bile.

Cirrhosis--Liver disease.

D

Dyspepsia--Impairment of the power or function of digestion.

E

Edema--Abnormally large amounts of fluid in the intercellular tissue spaces of the body, usually in the subcutaneous tissues.

Exudate--Material such as fluid, cells, or cellular debris which has escaped from blood vessels and has been deposited in tissues or on tissue surfaces, usually as the result of inflammation.

F

Flatulence--The presence of excessive amounts of air or gases in the stomach or intestine, leading to distention of the organs.

Fulminant--Sudden, severe; occurring suddenly and with great intensity.

G

Genesis--The coming into being of anything; the process of originating.

H

Hemophilia--A hereditary tendency to bleed spontaneously.

Histamine--A normal cellular product, which can have harmful effects if present in abnormal amount. It can contract most smooth muscle, increase gastric secretion, drop the blood pressure and accelerate the heart rate.

Hypotension--Abnormally low blood pressure.

I

Incontinence--Inability to control defecation or urination.

Insidious--Of gradual or subtle development.

J K L

Leptospirosis--Infections transmitted to man from dogs, swine, rodents, or contact with contaminated water, as in swamps, canals, or ponds.

Lobule--A small lobe (portion of an organ).

M

Malaise--A vague feeling of bodily discomfort.

Mononuclear--A cell having a single nucleus.

Mononucleosis--The presence of an abnormally large number of a type of white blood cells in the blood.

N O P

Parenteral--By injection through any route.

Phagocytosis--The engulfing of microorganisms, other cells, and foreign particles by a cell called a phagocyte.

Phlogram--Kidney function which fills the kidneys with a contrasting medium.

Pruritus--Itching.

Q R

Reagent--A substance employed to produce a chemical reaction.

S

Serum--The clear portion of any animal liquid separated from its more solid elements; especially the clear liquid which separated in the clotting of blood.

Sinusoid--Resembling a cavity or channel.

Splenomegaly--Enlargement of the spleen.

Strabismus--Deviation of the eye which the patient cannot overcome.

Subclinical--Without clinical manifestations; early stages or slight degree of a disease.

Subcutaneous--Beneath the skin.

T

Tachycardia--Excessively rapid heart rate, usually above one hundred per minute.

U V

Vasoconstrictor--Causes the diameter of the blood vessels to become smaller and thus decreases blood flow.

Virulence--The degree of the ability of a microorganism to invade the tissues of the host. It is measured experimentally by the median lethal dose.

W X Y Z

End of Appendix B